BANGALORE WATER SUPPLY
AND
SEWERAGE BOARD
CAUVERY BHAVAN, KEMPEGOWDA ROAD,
BANGALORE – 560 009

TENDER FOR

The Work of providing water supply facilities to Suryanagar phase IV developed by KHB under deposit contribution works.

Office of the Chief Engineer (Project)
BANGALORE WATER SUPPLY & SEWERAGE BOARD
3rd floor, Cauvery Bhavan,
K G road, Bangalore 560009.
Telephone – 080 22945108

e-mail – cep@bwssb.gov.in

TENDER REFERENCE :	:	BWSSB/CE(P)/ACE(Cst-DCW)/ 1879/2025-26 Dt: 23.12.2025
DATE OF PUBLICATION IN KPP-PORTAL	:	26.12.2025
LAST DATE FOR SUBMISSION OF TENDER IN E PORTAL	:	19.01.2026 up to 1600 hrs
TIME AND DATE OF OPENING OF TECHNICAL TENDER	:	20.01.2026 after 1700hrs.
PLACE OF OPENING OF TECHINCAL TENDER	:	Office of the Chief Engineer(Project), 3rd floor, Cauvery Bhavan, K G road, Bangalore 560009.
TIME AND DATE OF OPENING OF PRICE TENDERS	:	Will be intimated to the Qualified Tenderers
PLACE OF OPENING OF PRICE TENDER	:	Will be intimated to the Qualified Tenderers
ADDRESS FOR COMMUNICATION	:	**Chief Engineer (Project)** 3rd floor, Cauvery Bhavan, K G road, Bangalore 560009. Telephone – 080 22945108 e-mail – cep@bwssb.gov.in

Contents

Section No. Description Page

1	INVITATION FOR TENDERS (IFT)	3
2	INSTRUCTIONS TO TENDERERS (ITT)	7
3.	QUALIFICATION INFORMATION	23
4.	FORM OF TENDER, LETTER OF ACCEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM	27
5.	CONDITIONS OF CONTRACT (CC)	31
6.	CONTRACT DATA	51
7	SPECIFICATIONS	55
8	DRAWINGS	106
9.	BILL OF QUANTITIES	107
10.	FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT	108

SECTION 1:

BANGALORE WATER
SUPPLY AND SEWERAGE BOARD
Office of the Chief Engineer (Project)

3rd Floor, Cauvery Bhavan, K.G. Road, Bangalore 560009
Website www.bwssb.org email cep@bwssb.gov.in
Telephone: +91-80- 22945108

INVITATION FOR TENDER
(ONLY THROUGH E-PROCUREMENT PORTAL)
www.kppp.karnataka.gov.in)

IFT No.: BWSSB/CE(P)/ ACE(Cst DCW)/ 1879 /2025-26 Dated: 23.12.2025

1. The **Office of the Chief Engineer (Project)** invites tender from eligible tenderers, for the construction of work detailed in the Table below through KPPP process with two stages tender procedure in line with the Rule 28 of the KTPP Act. The details regarding their qualification to take the tender (as detailed in ITT Clause 3) and the price tender shall be uploaded in the website of the e-procurement wizard. Technical details will be opened on the date and time mentioned in IFT clause 5 and evaluated. The price tender of the Tenderer, who is found to be qualified to execute the tendered works, will be opened on the date notified later. The Tenderers are advised to note the minimum qualification criteria specified in Section -2 Clause 3 of the Instructions to Tenderers (ITT) to qualify for award of the contract.

2. Tender documents may be downloaded through the KPPP wizard which will link to www.karnataka public procurement portal from 26.12.2025 to 19.01.2026 on payment of a non-refundable fee indicated in the Table below, using any of these forms of OTC,NEFT, DEBIT CARD and CREDIT CARD through KPP portal only**.** Interested tenderers may obtain further information at the Office of KPPP. Tenderers will be issued a password and authorized for accessing the tender document in the website with URL: **www.karnataka public procurement portal**

3. The Bidders can download the e-tender document using their user ID –password, by accessing **www.karnataka public procurement portal** where electronic tender form is provided. Additional information related to e-tender process can be obtained through the above mentioned website. The electronic tender will be operated as Two stage Tender system by opening the Technical details first and financial portion of the eligible tenderers later.

4. Tenders must furnish Earnest Money Deposit specified for the work in the Table below. Earnest Money Deposit will have to be paid through any one of the forms OTC,NEFT, DEBIT CARD and CREDIT CARD through e-portal only.

5. Contractors should have registration in KPWD of State Government organization, public sector under takings, other state Governments.

BANGALORE WATER SUPPLY AND SEWERAGE BOARD

Office of the Chief Engineer (Project)

3rd Floor, Cauvery Bhavan,
KG Road, BANGALORE 560 009

NO.BWSSB/CE(P)/ ACE (Cst DCW)/ 1879 /2025-26 Date: 23 .12.2025

INVITATION FOR SHORT TERM TENDER (IFT)
(Through Karnataka Public Procurement Portal Only)

BWSSB, invites item rate e-Tenders in Two Stage Tender system from eligible contractors through KPP Portal for the following work:

Sl. No	Name of Work	Cost of Tender Document Rs.	Amount put to Tender in Lakh excluding GST Rs.	Bid Security in Lakh (Rs.)	Period of completion
(1)	(2)	(3)	(4)	(5)	(6)
1	Work of providing water supply facilities to Suryanagar phase IV developed by KHB under deposit contribution works.	To be specified by KPPP cell.	4232.42	42.33	24 months (Including monsoon period)

The tender documents can be downloaded through website www.karnataka public procurement portal from: 26.12.2025 to 19.01.2026. The Last date for submission of completed tender documents through KP procurement portal is 19.01.2026 upto 1600 **hrs** and date of opening of tender on 20.01.2026 after 1700 hrs**.**

The details of work / eligibility of contractor etc can be had from website www.karnataka public procurement portal Further particulars may be obtained from the above office during office hours & also from website www.karnataka public procurement portal

S/d-

Chief Engineer(Project)

BWSSB

6. Uploading signed copy of Form of Tender should be mandatory.

7. The bids will be opened at the office mentioned in para No.12 on 11.04.2025 at 1100 hrs in the presence of bidders or their authorized representatives. If the bid opening day remains as public holiday, Bids will be opened on the next working day at the original stipulated time.

8. Bidders can access tender documents from the website and upload the required details; those are mentioned in different sections in the bid document in to electronic tender box on the website. Scanned documents those are required to be furnished as per Section 2, 3 & 4 of the bid document shall be submitted through e-portal preferably in **PDF** format for clear vision.

9. The cost of the tender document once paid will not be refunded.

10. Applications / requisitions from joint venture Firms are not acceptable.

11. The cost of the tender document once paid will not be refunded.

12. The successful bidder would be required to give performance **bank guarantee of 5%** of the contract amount plus additional security for unbalanced bid amount from a Nationalized / Scheduled Indian Bank, with jurisdiction at Bangalore as specified in the clause no.29 of ITT, towards guarantee for completion of work within the stipulated period.

13. Bangalore Water Supply and Sewerage Board reserve the right to cancel or annul the entire or part of this process of invitation at any time without assigning any reason.

14. For any additional information regarding the above tender, the firms who are interested to quote, may contact office of the undersigned at the office address given below on all working days during office hours 1030hours to 1700 hours.

The Chief Engineer (Project),
Bangalore Water Supply and Sewerage Board
3rd Floor, Cauvery Bhavan D- Block,
Kempe Gowda Road, Bangalore - 560009
Karnataka, India.
Telephone: +91-80- 22945108
e-mail ID: cep@bwssb.gov.in
Or **visit Website** www.karnataka public procurement portal

15. List of documents to support qualification of bidder is to be uploaded to the e-Portal website www.karnataka public procurement portal

16. Bidders shall submit offers that comply with the requirements of the bid document, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered. The attention of the bidders is drawn to clause 23 regarding the rejection

of the bids, which are not substantially responsive to the requirement of the bid document.

17. Other details can be read from the tender documents.

18. Corrigendum/ Modification / Corrections, if any will be published in the website only.

Chief Engineer (Project)
BWSSB

SECTION 2:

INSTRUCTIONS TO TENDERERS (ITT)

Table of Clauses

		Page No.
A.	**General**	
	1. Scope of Tender	9
	2. Eligible Tenderers	9
	3. Qualification of the Tenderer	9
1	4. One Tender per Tenderer	11
2	5. Cost of Tendering	11
3	6. Site Visit	11
B.	**Tender Documents**	
1	7. Content of Tender documents	11
2	8. Clarification of Tender Document	11
	9. Amendment of Tender documents	12
C.	**Preparation of Tenders**	
	10. Documents comprising the Tender	12
	11. Tender prices	13
	12. Tender validity	13
	13. Earnest money deposit	14
	14. Format and signing of Tender	14
D.	**Submission of Tenders**	
	15. Sealing and marking of Tenders	15
	16. Deadline for submission of Tenders	16
1	17. Late Tenders	16
	18. Modification and Withdrawal of Tenders	16
E.	**Tender opening and evaluation**	
1	19. Opening of First Cover of all Tenders and evaluation to determine qualified Tenderers	17
	20. Opening of Second Cover Tenders of qualified Tenders and evaluation	17
	21. Process to be confidential	18
	22. Clarification of Tenders	18
	23. Examination of Tenders and determination of responsiveness	19
	24. Correction of errors	19
	25. Evaluation and comparison of Tenders	19
F.	**Award of contract**	
	26. Award criteria	20
	27. Employer’s right to accept any Tender and to reject any or all Tenders	20
	28. Notification of award and signing of Agreement	20
	29. Security deposit	21
	30. Advance payment and Security	21
	31 Corrupt or Fraudulent Practices	21

A. General

1. Scope of Tender

1.1 ***The Chief Engineer(Project), BWSSB,*** (Referred to as Employer in these documents) invites tenders following Two Cover e-procurement procedure, from eligible Tenderers, for the construction of work (as defined in these documents and referred to as "the work") detailed in the Table given in the Invitation for Tenders (IFT).

2. Eligible Tenderers

2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of Karnataka

2.2 Tenders from Joint ventures are not acceptable.

3. Qualification of the Tenderer:

1 3.1 All Tenderers shall provide the requested information accurately and in sufficient detail in Section 3: Qualification information.

1 3.2 **To qualify for award of this contract, each Tenderer in its name should have in the last five years i.e. 2020-21 to 2024-25).**

2

(a) Achieved in at least two financial years a minimum financial
turnover (in all classes of civil engineering construction works only) of Rs. **Rs. 4994.26 lakh**.

b) i. As a prime contractor should have satisfactorily completed and commissioned at least one similar work of construction of water retaining structure /GLR of value not less than **Rs. 1135.25 lakh.**

ii. As a prime contractor should have satisfactorily completed and commissioned at least one similar work of providing & laying of water supply pipeline of value not less than **Rs.1361.88 lakh.**

iii. The contractor should have constructed and commissioned 12ML capacity RCC Ground level water retaining reservoir with RCC roof.

iv. The contractor should have constructed and commissioned 1 No. of 1.5 ML capacity RCC Over Head water tank with15 meter staging.

v. 1 No. of Chlorination system **of 5kg/cm^2**(minimum) with scrubber system.

(c) Executed in any one year, the following minimum quantities of

work:

i.	Earth work excavation	:	35500 cum
ii.	RCC of M 30 grade	:	4979 cum
iii.	MS pipeline of 508mm dia& above	:	280 m
iv.	DI pipe of 200mm dia& above	:	14840 m
v.	Reinforcement TMT bars	:	700 T

(d) Deleted.

(e) Deleted.

3.3 **Each Tenderer should further demonstrate**:

0 Each Tenderer should further demonstrate:

a. Availability by owning 50% of the required / specified key & critical equipment for this work & remaining 50% can be deployed on lease / hire basis for all works provided, the relevant documents (commitment agreements etc.,) for availability for this work shall be furnished. Some of the equipments are as follows:

Sl No.	Details	Nos
1	Batching plant of 30m^3/Hr capacity	1
2	Pin vibrators-60mm	10
3	Excavator (poclain)	4
4	Tractors	2
5	Dewater pumps	4
6	Compressors	3
7	Pipe laying accessories like tripod, chain pully etc.,	2
8	Excavator, DG	3
9	Road cutting machine	2

[In case of hiring, agreement copy for such arrangement shall be furnished]

b. Liquid assets and /or availability of credit facilities of no less than **Rs. 832.40 lakh.-**(Credit lines/letter of credit/certificates from Nationalized / Schedule banks in India for meeting the fund requirement etc.,

3.4 To qualify for a package of contracts made up of this and other contracts for which tenders are invited in this IFT, the Tenderer must demonstrate having experience and resources to meet the aggregate of the qualifying criteria for the individual contracts.

3.5 Sub-contractors' experience and resources shall not be taken into account in determining the Tenderer's compliance with the qualifying criteria except to the extent stated in 3.2 (d) and (e) above.

1 3.6 Tenderers who meet the above specified minimum qualifying criteria, will only be qualified, if their available tender capacity is more than the total tender value. The available tender capacity will be calculated as under:

Assessed available tender capacity = (A*N*1.5 - B)

where

A = Maximum value of civil engineering works executed in any one year during the last five years (updated to **2025-26** price level) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which tenders are invited.

B = Value, at **2025-26** price level, of existing commitments and on-going works to be completed during the next **1** years (period of completion of the works for which Tenders are invited)*

Note: The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Employer in charge, not below the rank of an Executive Engineer or equivalent.

3.7 Even though the Tenderers meet the above criteria, they are subject to be disqualified if they have:

- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

4. One Tender per Tenderer:

4.1 Each tenderer shall submit only one tender for one package. A tenderer who submits or participates in more than one Tender (other than as a sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Tenderer's participation to be disqualified.

5. Cost of Tendering:

5.1 The tenderer shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible and liable for those costs.

6. Site visit:

6.1 The Tenderer at his own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The cost of visiting the Site shall be at the Tenderer's own expense.

B. Tender documents

7. Content of Tender documents

7.1 The set of tender documents shall have all the Sections given in Page 2:

7.2 Both the sets should be completed and returned with the tender.

8. Clarification of Tender Documents

8.1 A prospective tenderer requiring any clarification of the tender documents may notify the Employer in writing or by cable (hereinafter "cable" includes telex, facsimile and e-mail) at the Employer's address indicated in the invitation to tender. The Employer will respond to any request for clarification which he receives earlier than 15 days prior to the deadline for submission of tenders. Copies of the Employer's response will be forwarded to all purchasers of the tender documents through e-mail, including a description of the enquiry but without

identifying its source. Same will available in the website of e-procurement www.karnataka public procurement portal

8.2 Pre-tender meeting:

8.2.1 The tenderer or his authorized representative is invited to attend a pre-tender meeting which will take place at Office of the Chief Engineer (Project), Bangalore Water Supply & Sewerage Board, 3rd floor, Cauvery Bhavan, K.G.Road, Bangalore -560009 on **06.01.2026 at 14.30 Hrs**

8.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

8.2.3 The tenderer is requested to submit any questions in writing or by cable to reach the Employer not later than one week before the meeting.

8.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay to all purchasers of the tender documents. Any modification of the tender documents listed in Sub-Clause 7.1 which may become necessary as a result of the pre-tender meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 9 and not through the minutes of the pre-tender meeting.

8.2.5 Non-attendance at the pre-tender meeting will not be a cause for disqualification of a tenderer.

9. Amendment of Tender documents

9.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.

9.2 Any addendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents.

9.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders, in accordance with Sub-Clause 16.2 below.

C. Preparation of Tenders

10. Documents comprising the Tender

10.1 The tender submitted in e-procurement portal by the Tenderer shall contain the documents as follows:

(a) Scanned copy of Earnest Money Deposit made ;
(b) Scanned copies of Qualification Information as per formats given in Section 3;
(c) The Tender (in the format indicated in Section 4)
(d) Priced Bill of Quantities (Section 9);

and any other materials required to be completed and submitted by Tenderers in accordance with these instructions. The documents listed under Sections 3, 4, 6 and 9 shall be filled in without exception. The Earnest Money Deposit shall be submitted to the Tender inviting authority on or before the time of submission mentioned in IFT. PHOTOCOPIES OF THE DOCUMENTS SHOULD BE NOTARISED.

(e) The Form of Tender (in the format indicated in Section 4) (Mandatory)

10.2 Deleted.

11. Tender prices

11.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Tenderer.

11.2 The bidder shall fill in the unit rates in figures for all items of the Works described in the Bill of Quantities. The system will automatically convert the unit rates mentioned in figures to words and also calculate the amount of that item as well as the total Bid value. *Items for which no rate is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates in the Bill of Quantities*

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Tenderer.

11.4 Deleted

12. Tender validity

12.1 Tenders shall remain valid for a period not less than **ninety days** after the deadline date for tender submission specified in Clause 16. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

12.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Tenderers may extend the period of validity for a specified additional period. The request and the Tenderers' responses shall be made in writing, KPPP or by e-mail. A Tenderer may refuse the request without forfeiting his earnest money deposit. A Tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 13 in all respects.

13. Earnest money deposit

13.1 The Tenderer shall furnish, as part of his tender, earnest money deposit in the amount as shown in column 2 of the Table of IFT for this particular work. This earnest money deposit shall be in favour of Chairman, BWSSB through KPPP, payable at BANGALORE from any Nationalised / Scheduled Indian banks.

13.2 Instruments having fixed validity issued as earnest money deposit for the tender shall be valid for 45 days beyond the validity of the tender.

13.3 Any tender not accompanied by an acceptable earnest money deposit and not secured as indicated in Sub-Clauses 13.1 and 13.2 above shall be rejected by the Employer as non-responsive.

13.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period specified in Sub-Clause 12.1.

13.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

13.6 The earnest money deposit may be forfeited:

(a) if the Tenderer withdraws the Tender after tender opening during the period of tender validity;
(b) if the Tenderer does not accept the correction of the Tender Price, pursuant to Clause 24; or
(c) in the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
    (i) sign the Agreement; or
    (ii) furnish the required Security deposit

14. Format and signing of Tender

14.1 The completed bid comprising of documents indicated in ITB 10, should be uploaded in the **KPP portal** through the website **www.kppp.gov.in** along with scanned copies of requisite certificates those are mentioned in different sections in the bid document and scanned copy of Bid Security / EMD in case it is provided in the form of Banker's cheque/ Demand draft/Pay Order

14.2 All the documents should be uploaded to the **KPPP only**. Tenderer should take a print out of the declaration letter provided in the website on company letter head and should sign, stamp and upload the same to the tender wizard of BWSSB.

14.3 Deleted

D. Submission of Tenders

15. Up-loading & submission of tenders

15.1 The tenders should be uploaded only through **e-procurement portal**. Tender should contain

A. Technical Tender consisting of following:

a. All the documents with required details in prescribed format; those are mentioned in different sections in the Tender. Form of Tender, Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2, etc., shall be downloaded, filled with required details, signed, scanned & uploaded to the e-procurement portal website www.kppp.karnataka.gov.in on or before the time and date indicated in notification /Section I IFT.

b. **Tender security.** Tender security can be paid to BWSSB in the form of Banker's cheque/ Demand draft/Pay Order (the details like reference number, date, name of the Bank and drawn in favour are to be registered on the tender wizard of BWSSB)

The above documents along with notarized copies of documentary evidences as indicated in Section—II ITT, Section-III Qualification information & Section IV Forms of Tender shall be scanned and uploaded to the website compulsorily, failing which tender will be rejected in view of incomplete bid document and

B. Financial Tender consisting of Bill of Quantities (file name: BOQ.xls). The tenderer shall down load the bill of quantities and key in the rates (in figures only) in the Bill of Quantities sheet and upload the same file on to the website on or before the time and date indicated in notification /Section I IFT.

Scanned copy of Bid security (as cited in IFT Para No.2) provided in the form of Banker's cheque/ Demand draft/Pay Order, is to be uploaded to the KPPP before 19.01.2026 at **1600 hrs.**

In case of failure of the tenderer to submit the same within stipulated time, their tender will be rejected.

NOTE:

1. URL of the Website for tender submission through e-procurement portal is as follows:

i www.karnataka public procurement portal**.**

ii **Chief Engineer (Project)**
Bangalore Water Supply and Sewerage Board,
3rd Floor, Cauvery Bavan,
K.G. Road, Bangalore560009
Karnataka, India.
Telephone: +91-80- 22945108

2. The details related to submission of tenders, downloading / uploading of documents or other details are available online in the help wizard, Vendor manual & FAQ of above website. The same is provided along with sample formats in Annexure-I of the Bid document for ready reference.

15.2 Deleted

15.3 Unique Identification Number will be automatically generated by the server with time - stamp and sent to the account of the bidder as an acknowledgement after bidder finally uploads the bids.

15.4 Deleted.

16. Deadline for submission of the Tenders

16.1 Tenders must upload all the tender documents in the Karnataka Public procurement portal not later than 09.04.2025 **Upto 1600 Hrs**. In the event of the specified date for the submission of tenders being changed / postponed by the Employer due to unforeseen circumstances, the corrigendum will be issued in the news paper & the deadline for submission of tenders will be intimated accordingly.

16.2 The Employer may extend the deadline for submission of tenders by issuing an amendment/corrigendum in accordance with Clause 9, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

17. Late Tenders

17.1 The software of kppp system will not allow the Bidder to upload the documents after expiration of the stipulated date & time of Bid submission. The Bidder shall refer the server time, which will be displayed in the e-procurement portal of BWSSB. Employer will not be responsible for non-receipt of bids on the stipulated date & time prescribed in clause 16, due to Internet Problems, improper uploading or any other related problems. In case of connectivity problems, Tenderer may contact Helpdesk of the e-tender service provider and may also draw the attention of tender inviting authority.

18. Modification and Withdrawal of Tenders

18.1 Tenderers may “modify” and “withdraw” their tenders multiple numbers of times, until the deadline for submission of tenders by operating the relevant provision made in e-tendering. If the Tenderer withdraws the tender before the deadline for submission of tenders and later if he is interested to submit the tender once again, may do so within the stipulated date & time as mentioned in Clause 16. In this case within the stipulated date & time, the tenderer can once again submit the requisition to the officer inviting tenders for access to the withdrawn tender document for resubmission. For this tenderer need not make any additional payment towards the cost of tender document. Communication of modification / withdrawal by other means will not be accepted.

18.2 Deleted.

18.3 No Tender may be modified after the deadline for submission of tenders.

18.4 Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 12.1 above or as extended pursuant to Clause 12.2 may result in the forfeiture of the earnest money deposit pursuant to Clause 13.

18.5 Tenderers may offer discounts for individual items by simply modifying the quoted unit price in the Bill of Quantities. Also, Tenderer may enter their overall discount, at specified location in the Bill of Quantities only, by submitting tender modifications in accordance with this clause. Communication of discount by other means will not be accepted.

E. Tender opening and evaluation

19. Opening of Technical portion of Tenders and evaluation to determine qualified Tenderers:

19.1 The Employer will open the Technical details of all the Tenders received (except those withdrawn), including modifications made pursuant to Clause 18, in the presence of the Tenderers or their representatives on **19.01.2026 after 1600hrs .** In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will be opened at the appointed time and location on the next working day.

19.2 WITHDRAWAL proposal submitted pursuant to clause 18 shall be read out first and their bids shall not be opened.

19.3 The Tenderers names, the presence or absence of earnest money deposit (amount, format and validity), the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the Employer at the opening.

19.4 The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Clause 19.3.

19.5 The Price Tenders of all the Tenderers including modifications for Financial tenders can not be opened as this is programmed to open later after evaluation of the Technical details of the participating Tenderers.

19.6 The Employer will evaluate and determine whether each tender (a) meets the eligibility criteria defined in ITT Clause 2; (b) is accompanied by the required earnest money deposit as per stipulations in ITT Clause and (c) meets the minimum qualification criteria stipulated in ITT Clause 3. The Employer will draw out a list of qualified Tenderers.

20. Opening of Price Tender of qualified Tenderers and evaluation:

20.1 The Employer will inform all the Qualified Tenderers the time, date and venue fixed for the opening of the price Tenders. The Employer will open the price tender of Qualified Tenderers at the appointed time and date in the presence of the Tenders or their representatives who choose to attend. In the event of the specified date of Price tender opening being declared a holiday for the Employer, the price tenders will be opened at the appointed time and location on the next working day.

20.2 Deleted.

20.3 The Tenderers' names, the Tender prices, the total amount of each Tender, any discounts, and withdrawals, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. No Tender shall be rejected at Tender opening.

20.4 The Employer shall prepare minutes of the Price Tender opening, including the information disclosed to those present in accordance with Sub-Clause 20.3.

21. Process to be confidential

21.1 Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

22 Clarifications of Tenders

22.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders in accordance with Clause 24.

22.2 Subject to sub-clause 22.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.

22.3 Any effort by the Tenderer to influence the Employer in the Employer’s Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers’ Tender.

23. Examination of Tenders and determination of responsiveness

23.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender; (a) has been properly signed; and; (b) is substantially responsive to the requirements of the Tender documents like [(a)Form of Tender, (b)Declaration statement regarding Customs/ Excise duty exemption for materials/ construction equipment brought to site as mentioned in Section 2 etc.,] Scanned / uploaded [including documents those are required to be furnished as per Section 2, 3 & 4 of the tender,]; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the tendering documents.

23.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

23.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

24. Correction of errors

24.1 (a) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, rate in words will be auto generated by the system.

(b) Once the Tenderer key in the rates in figures, in the Bill of quantities provided, the system will automatically calculate the amount of that item as well as the total Bid value.

24.2 Deleted

25. Evaluation and comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be substantially responsive in accordance with Clause 23.

25.2 Deleted.

25.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Tender evaluation.

25.4 The estimated effect of the price adjustment conditions under Clause 41 of the Conditions of Contract, during the implementation of the Contract, will not be taken into account in tender Evaluation

25.5 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer's estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 29 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

26. Award criteria

26.1 Subject to Clause 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 2, and (b) qualified in accordance with the provisions of Clause 3.

27. Employer's right to accept any Tender and to reject any or all Tenders

27.1 Notwithstanding Clause 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

28. Notification of award and signing of Agreement

28.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex, e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of Security deposit in accordance with the provisions of Clause 29.

28.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 days following the notification of award along with the Letter of Acceptance. Within 20 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

28.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Security deposit

29.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in the form of Bank Guarantee for an amount equivalent to 5% of the Contract price plus additional security for unbalanced tenders in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract. :

- Cash or

1 - Banker's cheque/Demand Draft/Pay order/Bank guarantee in favour of ***Chief Engineer (Project), BWSSB*** payable at ***Bangalore***

2 - A Bank Guarantee in the form given in Section 10;

29.2 If the security deposit is provided by the successful Tenderer in the form of a Bank Guarantee only, it shall be issued either by a Nationalized/Scheduled bank.

29.3 The security deposit if furnished in cash or demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.

29.4 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

30 Advance Payment and Security:

30.1 The Employer will provide an advance payment on the contract price as stipulated in the Conditions of Contract, subject to the maximum amount as stated in the Contract Data.

31. Corrupt or Fraudulent practices

31.1 The GOK requires that the Tenderers/Suppliers/Contractors, observe the highest standard of ethics during the procurement

and execution of such contracts. In pursuance of this policy, GOK :

(a) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a GOK contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a GOK contract.

31.2 Furthermore, Tenderers shall be aware of the provision stated in sub-clause 50.2 of the Conditions of Contract.

SECTION 3:

QUALIFICATION INFORMATION

The following form is to be downloaded, particulars are to be filled, scanned & uploaded by the Bidder, to the tender wizard of BWSSB **"**www.eproc.karnataka.gov.in**"** along with the Bid.

Note: The detailed procedure for downloading / uploading the documents will be available in Help wizard, Vendor manual & FAQ of the above mentioned Website.

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1 Constitution or legal status of Tenderer [Attach copy]
Place of Registration _____
(Attach Copy)

Principal place of business: _____

1.2 Total value of civil engineering construction works executed and payments received in the last five years (in Rs. Lakhs)[1]
2020-21 _____
2021-22 _____
2022-23 _____
2023-24_____
2024-25_____
(Attach turnover certificate from Chartered Accounted along with balance sheets and P/L statement).

1.3 Work performed as Prime Contractor (in the same name) on works of similar nature over during the five years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Contract Number	Value of contract Rs. Lakhs	Date of issue of work order	Specified period of completion	Actual date of completion	Remarks explaining reasons for delay in completion of work
1	2	3	4	5	6	7	8	9

1.4 Quantities of work executed as prime contractor (in the same name) during the last five years specified in 1.2 above:

Year	Name of Work	Name of Employer	Quantity of work performed (cum)[2]	Remarks (Indicate contract reference)

[1] Attach Certificate from Chartered Account by uploading the scanned copies

[2] Items of work for which data is requested should tally with that specified in ITT Clause 3

			Cement Concrete	Masonry	Earthworks	
2020-21						
2021-22						
2022-23						
2023-24						
2024-25						

1.5 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of Work	Place& State	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs. lakhs)	Stipulated period of completion	Value of works[3] remaining to be completed (Rs. lakhs)	Anticipated date of completion
1	2	3	4	5	6	7	8

(B) Works for which Tenders already submitted:

Description of Work	Place & State	Name and Address of Employer	Estimated value of works (Rs. lakhs)	Stipulated Date period of completion	when decision is expected	Remarks if any
1	2	3	4	5	6	7

1.6. The following items of equipment are considered essential for successfully carrying out the works. The Tenderer should furnish all the information listed below.

Item of Equipment	Requirement[4]			Owned and available		Remarks
	No.	Capacity	Owned	Number/ Capacity	Age/ Condition	

[3] Contractor shall enclose / attach / up load all necessary certificates duly attested by the employer

[4] The Item of equipment, required number and capacity should match with those in ITT Clause 3.3(a) (Filled scanned & uploaded)

1.7 Reports on the financial standing of the tenderer, such as profit and loss statements and auditor's reports for the last five years;

1.8 Qualification and experience of the key technical and management personnel in permanent employment with the tenderer and those that are proposed to be deployed on this contract, if awarded.

1.9. Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.

1.10 Evidence of access to financial resources to meet the qualification requirement specified in ITT Clause3.3 (b): Cash in hand, Letter of Credit etc. List them below and attach certificate from the Banker in the suggested format as under:

FORMAT OF BANKER'S CERTIFICATE /LINE OF CREDIT LETTER
[TO BE ISSUED IN THE LETTER HEAD OF THE BANK BRANCH]

Reference Number (Sl No.) Place
Date
To
(Name & Address of the beneficiary)

This is to certify that Mr./ M/s. …….. [name of the customer] having is /their registered/administrative office at……is a customer of our bank and are engaged in……. (nature of activity). If the …..customer is allotted/awarded with …... (brief details of works], we may extend credit facilities upto Rs……. lakh, to meet his /their working capital requirement towards the execution of the said work order as per Loan policy of the Bank.

This credit is valid upto three months from the date of issue, that is upto dd/mm/yyyy.

Sd/-
Name of the Bank, Branch Manger
Address:
……

1.11 Proposals for subcontracting components of works amounting to more than 20% of the contract price .

Item of Work	Value of Sub-Contract	Identified Sub-Contractor (Name and address)	Experience of similar work [5]

[5] Attach Certificate from the respective Employers (scanned & Uploaded)

1.12 Information on litigations in which the Tenderer is involved:

Other Party (ies)	Employer	Details of dispute	Amount involved	Remarks showing present status

1.13 The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

SECTION 4:

FORM OF TENDER, LETTER OF ACEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM

Form of Tender

Description of the Works: Work of providing water supply facilities to Suryanagar phase IV developed by KHB under deposit contribution works.

To

Chief Engineer (Project)
Bangalore Water Supply and Sewerage Board,
3rd Floor, Cauvery Bhavan,
K.G. Road, Bangalore560009
Karnataka, India.

GENTLEMEN,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Tender.

This Tender and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

We undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988".

We hereby confirm that this Tender complies with the Tender validity and Earnest money deposit required by the Tender documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorized Signature:

Name & Title of Signatory:

_____

Name of Tenderer _____

Address: ----------

NOTE: This form shall be download, filled and printed on the Company letter head, Signed, Scanned and uploaded. Failure to furnish the signed copy will lead to Non-Responsive Tender. The price bid should not be filled in the form of tender, if so the tender will technically non-responsive.

Letter of Acceptance

(letterhead paper of the Employer)

_____[date]

To:

_____
[name and address of the Contractor]

Dear Sirs,

This is to notify you that your Tender dated _____ for execution of the _____ _____ [name of the contract and identification number, as given in the Instructions to Tenderers] for the Contract Price of Rupees —— _____ (_____) [amount in words and figures], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by our Agency.

You are hereby requested to furnish Security deposit plus additional security for unbalanced tenders in terms of Clause 25.5 of ITT, in the form detailed in Clause 29.1 of ITT for an amount of Rs.————— within 20 days of the receipt of this letter of acceptance valid up to 30 days from the date of expiry of Defects Liability Period i.e. up to ..... and sign the contract, failing which action as stated in Para 29.4 of ITT will be taken.

Yours faithfully,

Authorized Signature
Name and Title of Signatory
Name of Agency

Issue of Notice to proceed with the work

(letterhead of the Employer)

————— (date)

To
————————————— (name and address of the Contractor)
—————————————
—————————————

Dear Sirs:

Pursuant to your furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement for the construction of ————————[name of the contract] a Tender Price of Rs. ————————, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

Agreement Form

Agreement

This agreement, made the _____day of _____20_____, between_____ _____[name and address of Employer] (hereinafter called "the Employer") of the one part and _____ _____ _____ _____ __ _____[name and address of contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute _____ _____ _____ _____[name and identification number of Contract] (hereinafter called "the Works") and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a contract price of Rupees.....

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
   i) Letter of Acceptance;
   ii) Notice to proceed with the works;
   iii) Contractor's Tender;
   iv) Contract Data;
   v) Conditions of contract (including Special Conditions of Contract);
   vi) Specifications;
   vii) Drawings;
   viii) Bill of Quantities; and
   ix) Any other document listed in the Contract Data as forming part of the contract.
5. Jurisdiction of Courts/Arbitration: The sitting of arbitration shall be held at Bangalore only and nowhere else.
6. Dispute of any kind arising out of the contract shall be resolved within the jurisdiction of Bangalore City only and the parties agree and clearly

understand that the courts/tribunals situated at Bangalore Metropolitan City have exclusive jurisdiction for the redressal of the disputes arising out of the contract and at no other place.

7. The Parties further agree and understand that the place or places of issue of bank guarantee other than Bangalore will have no jurisdiction to resolve dispute of any kind relating to enforcement of the bank guarantees submitted by the contractor at Bangalore for the execution of the contract at Bangalore.

8. The contractor shall comply with all the legal requirements in the matter of employment of workmen and provide all safety gadgets to the workmen while working in the hazards place or conditions during the execution of the contract.

9. Contractor shall be fully responsible in the event of death of employee/workman during the execution of the work and liable to pay adequate compensation to the dependents of employee/workman as per law.

10. On his/their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amounts due to the contractor or by appropriate legal action.

11. If death of any employees occurs during execution of work due to negligence of contractor, the contract will be liable for termination.

12. In the event of such termination, the employer may consider blacklisting of firm after due notice.

13. In case of any death or accident the contract will be cancelled after following due process.

14. The Board will be entitled to claim exemplary damages from the contractor in case of death of any work man / employees of the contractor in any of the BWSSB works as it damages the reputation of the Board.

15. Road cutting machine should be used mandatorily while executing the work.

16. Any utilities encountered during execution if damaged by the contractor, the same need to be rectified immediately without any delay at his own cost with due approval from the concerned.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:
Signed, Sealed and Delivered by the said

_____

_____
___

in the presence of:

Binding Signature of Employer

_____

Binding Signature of Contractor

_____

SECTION 5:

CONDITIONS OF CONTRACT

Table of Contents

A. General **Page No**.

1. Definitions 35
2. Interpretation 36
3. Law governing contract 36
4. Employers decisions 36
5. Delegation 37
6. Communications 37
7. Subcontracting 37
8. Other Contractors 37
9. Personnel 37
10. Employer’s and Contractor’s risks 37
11. Employer’s risks 37
12 Contractor’s risks 38
13. Insurance 38
14. Site Investigation Report 39
15 Query about Contract Data 39
16 Contractor to construct the Works 39
17. The Works to be completed by Intended Completion Date 39
18 Approvals by the Employer 39
19. Safety 39
20. Discoveries 39
21. Possession of the Site 39
22. Access to the Site 40
23. Instructions 40
24. Procedure for resolution of disputes 40

B. Time Control

25. Program 40
26. Extension of the Intended Completion Date 40
27. Delays ordered by the Employer 41
28. Management meetings 41

C. Quality Control

29. Identifying defects 41
30. Tests 41
31. Correction of defects 41
32. Uncorrected defects 41

D. Cost Control

33 Bill of Quantities (BOQ) 42
34 Variations 42
35. Payment for Variations 42
36. Submission of bills for payment 43
37 Payments 43
38. Compensation events 43
39. Tax 44
40 Price Adjustment 44
41. Liquidated damages 44
42. Advance Payments 45
43. Securities 45

44. Cost of repairs 44

E Finishing of Contract
45. Completion 45
46. Taking Over 46
47. Final account 46
48. As built drawings and/or Operating and Maintenance Manuals 46
49. Termination 46
50 Payment upon termination 47
51. Property 47
52. Release from performance 47

F Special Conditions of Contract 48

Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Bold letters are used to identify defined terms.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Tender.

Compensation events are those defined in Clause 38 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Employer in accordance with Sub Clause 46.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.2 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Tender to carry out the Works has been accepted by the Employer.

The **Contractor's Tender** is the completed Tender document submitted by the Contractor to the Employer.

The **Contract price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; months are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects liability period** is the period named in the Contract Data and calculated from the Completion Date.

The **Employer** is the party who will employ the Contractor to carry out the Works.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

The **Site** is the area defined as such in the Contract Data.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Employer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

A **Variation** is an instruction given by the Employer which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor’s Tender
(4) Contract Data
(5) Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Law governing contract

3.1 The law governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's decisions

4.1 Except where otherwise specifically stated, the Employer will decide contractual matters between the Employer and the Contractor.

5. Delegation

5.1 The Employer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

7.1 Deleted

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer.

9. Personnel

9.1 The Contractor shall employ the technical personnel (of number and qualifications) as may be stipulated by GOK from time to time during the execution of the work. The technical staff so employed shall be available at site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's risks

11.1 The Employer is responsible for the excepted risks which are:

(a) rebellion, riot commotion or disorder unless solely restricted to employees of the Contractor or his Sub-Contractors arising from the conduct of the Works; or

(b) a cause due solely to the design of the Works, other than the Contractor's design; or

(c) any operation of the forces of nature (in so far as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen; or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures;

(A) prevent loss or damage to physical property from occurring by taking appropriate measures or
(B) insure against such loss or damage

12. Contractor's risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance:

13.1 The Contractor shall prior to commencing the works, effect and thereafter maintain insurances , in the joint names of the Employer and the Contractor, (cover from the first working day after the Start Date to the end of Defects Liability Period), in the amounts stated in the Contract Data :

(a) for loss of or damage to the Works, Plants and Materials and the Contractor's equipment;
(b) for liability of both Parties for loss, damage, death and injury to third parties or their property arising out of the Contractor's performance of the Contract including the Contractor's liability for damage to the Employer's property other than the Works and
(c) for liability of both Parties and of any Employer's representative for death and injury to the Contractor's personnel except to the extent that liability arises from the negligence of the Employer, any Employer's representative or their Employees.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Employer for his approval before the Start Date. All such insurance shall provide for compensation to be payable to rectify the loss or damage incurred. All payments received from insurers relating to loss or damage shall be held jointly by the Parties and used for the repair of the loss or damage or as compensation for loss or damage that is not to be repaired.

13.3 If the Contractor fails to effect or keep in force any of the insurances referred to in the previous sub-clauses or fails to provide satisfactory evidence, policies or receipts, the Employer may without prejudice to any other right or remedy, effect insurance for the cover relevant to such default and pay the premiums due and recover the same as a deduction from any other monies due to the Contractor. If no payment is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of insurance shall not be made without the approval of the Employer.

13.5 Both Parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports:

14.1 The Contractor, in preparing the tender, shall rely on any site investigation reports referred to in the Contract data, supplemented by any information available to the Tenderer.

15. Queries about the Contract Data

15.1 The Employer will clarify queries on the Contract Data.

16. Contractor to construct the Works

16.1 The Contractor shall construct the Works in accordance with the Specification and Drawings.

17. The Works to be completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Employer, and complete them by the Intended Completion Date.

18. Approval by the Employer:

18.1 The Contractor shall submit Specification and drawings showing the proposed Temporary Works to the Employer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for the design of Temporary Works

18.3 The Employer’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.

18.4 The Contractor shall obtain approval of third parties to the design of third parties to the design of the temporary Works where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Employer before their use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Employer of such discoveries and carry out the Employer's instructions for dealing with them.

21. Possession of the Site

21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Employer and any person authorized by the Employer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1 The Contractor shall carry out all instructions of the Employer which comply with the applicable laws where the Site is located.

24. Procedure for resolution of Disputes:

24.1 If the Contractor is not satisfied with the decision taken by the Employer, the dispute shall be referred by either party to Arbitration within 30 days of the notification of the Employer’s decision.

24.2 If neither party refers the dispute to Arbitration within the above 30 days, the Employer’s decision will be final and binding.

24.3 The Arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract.

B. Time Control

25. Program

25.1 Within the time stated in the Contract Data the Contractor shall submit to the Employer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

25.2 The Employer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

26. Extension of the Intended Completion Date

26.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date.

26.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information.

27. Delays ordered by the Employer

27.1 The Employer may instruct the Contractor to delay the start or progress of any activity within the Works.

28. Management meetings

28.1 The Employer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the progress achieved and the plans for remaining work.

28.2 The responsibility of the parties for actions to be taken is to be decided by the Employer either at the management meeting or after the management meeting and stated in writing to be distributed to all who attended the meeting.

C. Quality Control

29. Identifying defects

29.1 The Employer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Employer may instruct the Contractor to search for a Defect and to uncover and test any work that the Employer considers may have a Defect

30. Tests

30.1 If the Employer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

31. Correction of defects

31.1 The Employer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

31.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Employer’s notice.

32. Uncorrected defects

32.1 If the Contractor has not corrected a Defect within the time specified in the Employer’s notice, the Employer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. Cost Control

33. Bill of Quantities (BOQ)

33.1 The BOQ shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

33.2 The BOQ is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the BOQ for each item

34. Variations

34.1 The Employer shall have power to order the Contractor to do any or all of the following as considered necessary or advisable during the progress of the work by him

(a) Increase or decrease of any item of work included in the Bill of Quantities (BOQ);
(b) Omit any item of work;
(c) Change the character or quality or kind of any item of work;
(d) Change the levels, lines, positions and dimensions of any part of the work;
(e) Execute additional items of work of any kind necessary for the completion of the works; and
(f) Change in any specified sequence, methods or timing of construction of any part of the work.

34.2 The Contractor shall be bound to carry out the work in accordance with any instructions in this connection, which may be given to him in writing by the Employer and such alteration shall not vitiate or invalidate the contract.

34.3 Variations shall not be made by the Contractor without an order in writing by the Employer, provided that no order in writing shall be required for increase or decrease in the quantity of an item appearing in the BOQ so long as the work executed conforms to the approved drawings.

34.4 The Contractor shall promptly request in writing the Employer to confirm verbal orders and the officer issuing oral instructions shall confirm it in writing with in 30days, failing which the work shall be carried out as though there is no variation. In case variation is approved, it shall be accompanied by BOQ, failing which the contractor shall be responsible for deviation, if any.

35. Payments for Variations

35.1 Payment for increase in the quantities of an item in the BOQ up to 25% of that provided in the Bill of Quantities shall be made at the rates quoted by the Contractor.

35.2 For quantities in excess of 125% of the tendered quantity of an item as given in the BOQ, the Contractor shall be paid at the rate entered in or derived from in the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) plus or minus

the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract.

35.3 If there is no rate for the additional, substituted or altered item of the work in the BOQ, efforts would be made to derive the rates from those given in the BOQ or the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) and if found feasible the payment would be made at the derived rate for the item plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract

35.4 If the rates for additional, substituted or altered item of work cannot be determined either as at 35.1 or 35.2 or 35.3 above, the Contractor shall be requested to submit his quotation for the items supported by analysis of the rate or rates claimed, within 7 days.

1 35.5 If the Contractor's quotation is determined unreasonable, the Employer may order the Variation and make a change to the Contract Price which shall be based on Employer’s own forecast of the effects of the Variation on the Contractor's costs.

35.6 If the Employer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

35.7 Under no circumstances the Contractor shall suspend the work on the plea of non-settlement of rates for items falling under this Clause.

36. Submission of bills for payment

36.1 The Contractor shall submit to the Employer monthly bills of the value of the work completed less the cumulative amount paid previously.

36.2 The Employer shall check the Contractor's bill and determine the value of the work executed which shall comprise of (i) value of the quantities of the items in the BOQ completed and (ii) valuation of Variations and Compensation Events.

36.3 The Employer may exclude any item paid in a previous bill or reduce the proportion of any item previously paid in the light of later information.

37. Payments

37.1 Payments shall be adjusted for deductions for advance payments, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the within 60 days of submission of bill. The Contractor shall be liable to pay liquidated damages for shortfall in progress. For Progress beyond the agreed program, payment is subject to availability of the grants.

37.2 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

38. Compensation events

38.1 The following are Compensation events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.
(b) The Employer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.
(c) The Employer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.
(d) The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.
(e) The effect on the Contractor of any of the Employer’s Risks.
(f) The Employer unreasonably delays issuing a Certificate of Completion.
(g) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

38.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Employer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

38.3 As soon as information demonstrating the effect of each Compensation event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Employer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Employer shall adjust the Contract Price based on Employer’s own forecast. The Employer will assume that the Contractor will react competently and promptly to the event.

38.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Employer.

39. Tax

39.1 The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

40. Price Adjustment:

40.1 Contract price shall be adjusted for increase or decrease in rates and prices of materials, fuels and lubricants in accordance with the following principles and procedures and as per formulae given in the Contract Data.

1 (a) The price Adjustment shall apply for the work done from the date of commencement up to the end of original period of completion or extensions granted by the Employer and shall not apply to work carried out beyond the stipulated period of completion for reasons attributable to the Contractor;
2
3 (b) Price Adjustment shall be admissible from the date of opening of tenders (original or extended)
4 (c) The price adjustment shall be determined during each quarter from the formulae given in Contract Data.
5 (d) Following expressions and meanings are assigned to the work done during the quarter:

R = Total value of work done during the quarter. It will exclude value for works executed under variations for which price adjustment (if any) will be worked out separately based on the terms mutually agreed.

40.2 To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

41. Liquidated damages

41.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

41.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

42. Advance Payments:

42.1 The Employer shall make payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an unconditional bank guarantee in a form acceptable to the Employer issued by a Nationalized/Scheduled Bank in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be

progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

42.2 The Contractor is to use the advance payment only to pay for Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Employer.

42.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuation of the work done, variations, price adjustments, compensation events or liquidated damages.

43. Securities:

43.1 The Security deposit (including additional security for unbalanced tenders) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and type of instrument acceptable to the Employer. The Security deposit shall be valid until a date 30 days from the date of expiry of Defects Liability Period and the additional security for unbalanced tenders shall be valid until a date 30 days from the date of issue of the certificate of completion.

44. Cost of Repairs:

44.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

45. Completion

45.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

46. Taking over

46.1 The Employer shall take over the Site and the Works within seven days of issuing a certificate of Completion.

47. Final account

47.1 The Contractor shall supply to the Employer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 90 days of receiving the

Contractor's account if it is correct and complete. If it is not, the Employer shall issue within 90 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Employer shall decide on the amount payable to the Contractor and make payment within 60 days of receiving the Contractor's revised account.

48. As built drawings and /or Operating and Maintenance Manuals

48.1 If "as built"[6] Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

48.2 If the Contractor does not supply the Drawings by the dates stated in the Contract Data, or they do not receive the Employer's approval, the Employer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

49. Termination

49.1 The Employer may terminate the Contract if the other party causes a fundamental breach of the Contract.

49.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer;

(b) The Contractor becomes bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(c) the Employer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer;

(d) the Contractor does not maintain a security which is required;

(e) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

(f) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

For the purpose of this paragraph : "corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish

[6] Completion Drawings

Tender prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition."

49.3 When either party to the Contract gives notice of a breach of contract to the Employer for a cause other than those listed under Sub Clause 49.2 above, the Employer shall decide whether the breach is fundamental or not.

49.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

49.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

50. Payment upon Termination

50.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Employer shall prepare bill for the value of the work done less advance payments received up to the date of the bill, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

50.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Employer shall prepare bill for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract, and less taxes due to be deducted at source as per applicable law and make payment accordingly.

51. Property

51.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor's default.

52. Release from performance

52.1 If the Contract is frustrated by any event entirely outside the control of either the Employer or the Contractor the Employer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made

F. Special Conditions of Contract

1. Labour :

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Employer, deliver to the Employer a return in detail, in such form and at such intervals as the Employer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Employer may require.

2. Compliance with labour regulations :

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, Employer shall have the right to deduct any money due to the Contractor including his amount of security deposit. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

3. Protection of Environment:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be

passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

4. 4. Constitution of Dispute Adjudication Board Agreement.

In the interest of resolving disputes which may arise during the contract period an amicable settlement shall be preferred initially by constituting the Adhoc Dispute Adjudication Board (DAB) comprising the following members:

- Concerned Additional Chief Engineer from BWSSB
- Contractor representative
- The "Member" third party who is being identified/nominated jointly by both Employer and Contractor.

In case the DAB cannot arrive at any amicable decision the parties may refer the Dispute to Arbitration within the jurisdiction of Bangalore.

The cost of nomination of 3rd party member of DAB shall be equally borne by both the parties.

5 Contractor to Co-ordinate his Work with Other Contractors

5.1 The Contractor has to co-ordinate with the other concerned Contractors as already specified in Conditions of Contract for all such works as per the directions of Engineer in charge at no extra cost.

6 **Continuation of Work:**

6.1 In case of the death of a contractor after executing the agreement / commencement of the work, his legal heir, if any eligible registered contractor and willing, can execute and complete the work at the accepted tender rates irrespective of the cost of the work.

7. **Project Monitoring Consultant:**

This project will be executed under the super vision of Project Monitoring Consultant appointed by the Board for checking the measurements, quality assurance, quantity verification, documentation and reporting of the work status. The fee for the third-party inspection shall be paid by the Employer.

All the equipment materials which are to be tested at factory based on QAP approved by the Board, the cost of inspection need to be borne by the Contractor which includes accommodation/ TA/DA/food etc.

7. The contractor shall ensure the ESI and Provident Fund registration of the workers/labourers engaged in the work as per the Labour laws.

8. **Jurisdiction of Courts /Arbitration**: The sitting of Arbitration shall be held at Bangalore only and nowhere else.

9. Dispute of any kind arising out of the contract shall be resolved within the jurisdiction of Bangalore City only and the parties agree and clearly understand that the courts / tribunals situated at Bangalore Metropolitan City have exclusive jurisdiction for the

redressal of the disputes arising out of the contract and at no other place.

10. The parties further agree and understand that the place or places of issue of Bank Guarantee other than Bangalore will have no jurisdiction to resolve dispute of any kind relating to enforcement of the bank guarantees submitted by the contractor at Bangalore for the execution of the Contract at Bangalore.
11. The contractor shall comply with all the legal requirements in the matter of employment of workmen and provide all safety gadgets to the workmen while working in the hazards place or conditions during the execution of the contract.
12. Contractor shall be fully responsible in the event of death of employee / workman during the execution of the work and liable to pay adequate compensation to the dependents of employee/ workman as per law.
13. On his / their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amounts due to the contractor or by appropriate legal action.
14. If death of any employees occurs during execution of work due to negligence of contractor, the contract will be liable for termination.

15. In the event of such termination, the employer may consider blacklisting of firm after due notice.

16. In case of any death or accident the contract will be cancelled after following due process.

    a) The Board will be entitled to claim exemplary damages from the contractor in case of death of any work man / employees of the contractor in any of the BWSSB works as it damages the reputation of the Board.

17. The Bidder Should not have applied for or are now part of Corporate Debt Restructure (CDR) / SDR in the last 5 Financial Years.
18. The Contractor shall use tertiary treated water from BWSSB for Construction, Flow testing at the prevailing rates of BWSSB.
19. The Supply of pipes and other materials shall be initially for only 50% of the quantity of BOQ is considered and further supply will be as per the recommendations of the Engineer In-charge based on the requirement.
20. All required permissions/ROW issues from all concerned departments such as NHAI / Railways / any other department shall be obtained from the contractor and Board Engineers will assist for the same. Deposits payable to the departments will be borne by the Board.
21. No Variation work will be executed by the firm unless approval is conveyed from the Competent Authority.
22. The Hard Rock obtained during execution, will not be auctioned by Board (Because of the restriction in stocking of hard rock in site and safety issues). However Rs.70.00 per cum + applicable GST of Hard Rock will be recovered from the firm in Running bills.
23. Designated qualified safety officer/Engineer shall be deployed at site from the firm.
24. The estimate for the above work is prepared excluding GST.

25. In respect of Conditions of Contract clause 39, The contractors are being informed to quote their rate excluding GST. The GST, at the prevailing rate will be paid.
26. The Contractors shall carry out the above work considering the alignment of pipeline inlet & outlet pipeline already laid till GLR.
27. The Tenderer should have not been black listed by any Central / State Government Institutions in last 3 Financial Years. An undertaking (Self-Certificate) in this regard that the bidder hasn't been blacklisted by any Central / State Government Institution must be submitted.
28. Tenderer should inspect the site to know the existing Utilities if any before quoting.
29. The Bidder should not have incurred losses for more than 2 years in last Five financial years.
30. The Tenderer should upload the notarized copy of the Certificates. If the certificates are found to be not genuine, action will be taken on such tenderer and will be Black listed.
31. The firm has to provide latest version standard 2 Nos. PC (High end configuration), latest version laptop and colour printer A3 size to the designated office of the Board for project purpose at no extra cost till defect liability period.
32. In respect of Conditions of Contract of Section-C-Quality Control, Clause.35 of 35.1 under Payments for Variations for upto 125% of BOQ- The BOQ rates will be adopted. For above 125% the BOQ, rate is compared with SR of year of award plus TP rates and lesser among them will be considered.
33. The "As-built" drawing (in scale 1:100) in 5 sets need to be submitted in 5 sets both in hard copy and soft copy for approval within 30days of issue of certificate of completion of work by incorporating/updating in the GIS countersigned by PMC and BWSSB officials.
34. The contractor shall visit the site before attending the pre-bid meeting. The queries received after pre-bid meeting will not be entertained.
35. As per Conditions of Contract under Clause-18 of Approval by the Employer- The contractor has to carry out the survey and submit the drawing's as per the scope of work. After the verification and concurrence of the PMC, Contractor has to submit 6 sets of drawings for approval. The distribution of drawings by the employer as below:
    PMC- 1set.
    Employer-4 Sets
    Contractor- 1set.
36. In case of any death or accident the contract will be cancelled after following due process:

    1) Any utilities encountered during execution if damaged by the contractor, the same need to be rectified immediately without any delay at his own cost with due approval from the concerned.
    2) If any undue incidents with respect to non compliance to safety at site per decease, the contractor has to pay Rs. 10.00 Lakh immediately, failing which the Board will pay and the same will be recovered by the contractor.

37. **Restrictions on public procurement from bidders of certain countries**- The bidder/Tenders from a country which shares a land

border with India will be eligible to bid in any procurement of works (including turnkey projects) only if the bidder fulfils the criterions as per the Government order No. FD 455 Exp-12/2020, Bengaluru, dated: 28.8.2020.

38. Hydro testing and water required for hydro-testing shall be responsible of contractor.

39. M30 concrete BOQ rate shall as to be withheld by 5% till completion of hydro-testing.

40. Contractor need to provide the vehicle on rental basis with fuel, driver and other maintenance cost of XL6, Scorpio or equivalent till the completion and handing over of the project.

SECTION 6:
CONTRACT DATA

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract: Clause Reference

1 • The Schedule of Operating and Maintenance Manuals [48]
2
3 • The Methodology and Program of Construction [25]

4 • Site Investigation Reports [14]
5
6 • The Schedule of Key and Critical Equipment to be deployed on the work as per agreed program of construction. [25]

The Employer is :

Name: ***Chief Engineer (Project), BWSSB.*** [1.1]

Address: 3rd ***Floor, Cauvery Bhavan,***
Kempegowda Road,
Bangalore 560 009
Ph: 080-22945108

Name of authorized Representative: ***Executive Engineer (DC Works) Division***

Bangalore Water supply & Sewerage Board

Rajatha Bhavan 3rd floor, Margosa Road Malleshwaram,
Bangalore.s

The name and Identification number of the Contract is :	Work of providing water supply facilities to Suryanagar phase IV developed by KHB under deposit contribution works.

The Works involves Survey, detail geo technical investigations, Construction, hydraulic testing, commissioning of Work of construction of RCC GLR, OHT, service station, water supply pipeline works at Suryanagar Phase IV under Deposit Contribution Funds of BDA.

The start date shall be the date of issue of notice to proceed with the work. [1.1]

The Intended Completion Date for the whole of the Works is **Twenty Four (24) *Months*** with the following milestones [17, 26]

Milestone dates:

	Physical works to be completed	**Period from the date of issue of Notice to proceed with the work**	**Remarks**
Milestone-1 duration	• GLR- Raft with 1st lift of wall. • OHT-Foundation with staging. • Water supply pipeline- 50 % of total water supply pipeline work with allied works.	12 months from the date of agreement.	If the Milestone is not achieved within the time period, 5% of the cost of Milestone for balance work shall be withheld and will be released after achieving the target within the tender period. If the delay is attributed to the Contractor, as per the tender clause, the amount withheld will be adjusted for the delay damages to be levied.
Milestone - 1value in Rs-	2116.21 crores		
Milestone-2 duration	100% Completion of all works, with testing and commissioning.	Twenty Four months from the date of agreement.	
Milestone - 2 value in Rs-	2116.21 crores		

The Site Possession Date is: **After Issue of work order** [21]

The Site is located at Suryanagar Phase IV developed by KHB, Bangalore. [1.1]

Defects Liability Period is 365 days. [31]

Insurance requirements are as under: [13]

	Type of Cover	Minimum cover for Insurance
(i)	Works and of Plant and materials	The sum stated in the Agreement plus 20%

(ii)	Loss or damage to equipment	Full replacement cost
(iii)	Loss or damage to property of Third Party	Full replacement cost
(iv)	Personal injury or death insurance (a) for Third Party	Rs. 25.00 Lakhs
	(b) for Contractor's employees or labour	In accordance with the statutory requirements applicable to Karnataka

Payment Terms.

The employer will make the payment to the items on the following terms

For, MS Pipelines /DI pipes

60% of the contract price	After supply of Materials
20% of the contract price	After laying/installation of Materials.
10% of the contract price	After certification of Hydraulic/Electrical testing.
10% of the contract price	After Completion and commissioning of Works.

Valves, Air-Valves

75% of the contract price	After supply of Valves/ Electro mechanical equipment to site of work
20% of the contract price	After fixing in pipeline/erection.
5% of the contract price	After successful completion of work/ commissioning.

Steel Reinforcement for R.C.C work

75% of the contract price	After Supply of Steel to site of work.
25% of the contract price	After steel bending & binding at site of work.

Water Retaining M30 RCC Structures

95% of the contract price	After Completion of Respective items of works as per BoQ.
5 % of the contract price	After successful testing & commissioning of works.

Price Adjustment Formula [40]

R = Value of work as defined in Clause 40.1 of Conditions of Contract.

Adjustment for cement component

(i) Price adjustment for increase or decrease in the cost of cement procured by the contractor shall be paid in accordance with the following formula.

$V_c = 0.85 \times P_c/100 \times R \times (C_i - C_o)/C_o$, Where

V_c = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for cement

C_o = The all India average wholesale price index for **Ordinary Portland** for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi.

C_i = The all India average wholesale price index for **Ordinary Portland** for the quarter under consideration as published by Ministry of Industrial Development, Government of India, New Delhi

P_c = Percentage of cement component of the work

Note: *Index for all types of cement shall be considered from Cement –Group provided in the web site www.eaindustry.nic.in.*

Adjustment for steel reinforcement component

(ii) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$V_s = 0.85 \times P_s/100 \times R \times (S_i - S_o)/S_o$

V_s = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for steel

S_o = The all India average wholesale price index for steel (**MS Steel long products**) for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi

S_i = The all India average wholesale price index for steel (**MS Steel long products**) for the quarter under consideration as published by Ministry of Industrial Development, New Delhi

P_s = Percentage of steel reinforcement component of the work

Note: For the application of this clause, index of **MS Steel long products** has been chosen to represent steel group for general construction.

Adjustment for MS pipe component

(iii) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$V_s = 0.85 \times P_{ms}/100 \times R \times (S_i - S_o)/S_o$

V_s = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for steel

S_o = The all India average wholesale price index for steel **(Hot Rolled steels and plates (HR) Coils & Sheets, including Narrow Strip)** for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi

S_i = The all India average wholesale price index for steel **(Hot Rolled (HR) Coils & Sheets, including Narrow Strip)** for the quarter under consideration as published by Ministry of Industrial Development, New Delhi

P_{ms} = Percentage of MS pipe component of the work

Adjustment of DI Pipes component

(iv) Price adjustment for increase or decrease in the cost of DI Pipe shall be paid in accordance with the following formula:

$V_b = 0.85 \times P_{di}/100 \times R \times (D_i - D_o)/D_o$

V_b = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rate for Pig Iron.

D_o = The all India average Whole Sale price index of Pig Iron on the day 30 days prior to date of opening of Bids.

D_i = The all India average Whole Sale price index of Pig Iron of the quarter under consideration.

P_{di} = Percentage of DI pipe component of the work.

Note: For the application of this clause, index of **Pig Iron** has been chosen.

Adjustment for labour component

(v) Price adjustment for increase or decrease in the cost due to labour shall be paid in accordance with the following formula:

$V_L = 0.85 \times P_l/100 \times R \times (L_i - L_o)/L_o$ Where,

V_L = increase or decrease in the cost of work during the quarter under consideration due to changes in rates for local labour.

L_o = the average consumer price index for industrial workers for Bangalore centre for the quarter preceding the date of opening of Bids as published by Labour Bureau, Ministry of Labour, Government of India.

L_i = The average consumer price index for industrial workers for Bangalore centre for the quarter under consideration as published by Labour Bureau, Ministry of Labour, Government of India.

P_l = Percentage of labour component of the work.

Adjustment of POL (fuel and lubricant) component

(vi) Price adjustment for increase or decrease in cost POL (fuel and lubricant) shall be paid in accordance with the following formula:

$V_f = 0.85 \times P_f/100 \times R \times (F_i - F_o)/F_o$

V_f = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for fuel and lubricants.

F_o = The average official retail price of High Speed Diesel (HSD) at the existing consumer pumps of IOC at Bangalore on the day thirty days prior to the date of opening of Bids.

F_i = The average official retail price of HSD at the existing consumer pumps of IOC at Bangalore for the 15th day of the middle calendar month of the quarter under consideration.

P_f = Percentage of fuel and lubricants component of the work.

Note: **For the application of this clause, the price of High Speed Diesel oil has been chosen to represent fuel and lubricants group.**

Adjustment for Plant and Machinery Spares component

(vii) Price adjustment for increase or decrease in the cost of plant and machinery spares procured by the Contractor shall be paid in accordance with the following formula:

$V_p = 0.85 \times P_p/100 \times R \times (P_i - P_o)/P_o$

V_p = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for plant and machinery spares

P_o = The all India average wholesale price index for (heavy machinery and parts) for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi

P_i = The all India average wholesale price index for (heavy machinery and parts) for the quarter under consideration as published by Ministry of Industrial Development, New Delhi

P_p = Percentage of plant and machinery spares component of the work

Adjustment for Other materials

(viii) Price adjustment for increase or decrease in the cost of other materials other than cement, steel, bitumen and Fuel and Lubricants procured by the contractor shall be paid in accordance with the following formula:

$V_M = 0.85 \times P_M/100 \times R \times (M_i - M_o)/M_{o,}$ Where

V_M = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for local materials other than cement, steel, bitumen and Fuel and Lubricants.

M_o = The all India average wholesale price index for all commodities for the quarter preceding the date of opening of bids, as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi.

M_i = The all India average wholesale price index for all commodities for the quarter under consideration, as published by the Office of the Economic Advisor, Ministry of Commerce and Industry, Government of India, New Delhi

P_M = Percentage of other materials (other than cement, steel, bitumen and Fuel and Lubricants) of the work

The following percentages will govern the price adjustment for the entire contract:

1.	Cement - P_c	**% Will be intimated before contract signing**
2.	Steel Reinforcement - P_s	**-Do-**
3.	MS Pipe – P_{ms}	**-Do-**
4.	DI Pipe – Pdi	**-Do-**
5.	Labour – P_l	**-Do-**
6.	Fuel & Lubricants - P_f	**-Do-**
7.	Plant & Machinery Spares - P_P	**-Do-**
8.	Other Materials	**-Do-**
	Total	**100**

The liquidated damages for the whole of the works are
Rs. ***0.1%*** per day of the contract value and that for the milestones are as under:

The maximum amount of liquidated damages for the whole of the works is ten percent of final contract price. [41]
The amounts of the advance payment are:
[42]

Nature of Advance	Amount (Rs.)	Conditions to be fulfilled
Installment of Mobilization	5% of the Contract price	On submission of un-conditional Bank Guarantee. (to be drawn before end of 60 days)

Repayment of advance payment for mobilization:
[42]
The advance loan shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached not less than 15 percent of the Contract Price or 6 months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 7.5 percent of the amounts of all Interim Payment Certificates until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clauses 17 and 26.

The date by which “as-built”drawings (in scale **1:100**) in 2 sets are required is within 30 days of issue of certificate of completion of Whole or Section of the Work as the case may be. [48]

The amount to be withheld for failing to supply “As built” drawings by the date required is Rs. 2,00,000/- [48]

The following events shall also be fundamental breach of the contract:[49.2]

1. The contractor has contravened Sub-clause 7.1 and Clause 9 of CC.

The percentage to apply to the value of the work not completed representing the Employer's additional cost for completing the Works shall be ***30*** percent. [50.1]

SECTION 7:

TECHNICAL SPECIFICATIONS

Specifications as per relevant IS codes and Bill Of Quantities

I. GENERAL

1.1 Scope of Work.

2 The scope of works includes, taking up necessary survey and geotechnical investigation at site of proposed reservoir and make available such reports to employer in order to carry out the detailed design and issue of Good for construction drawings (GFCs) prior to carrying out detailed execution works.

3 Based on these test results and investigation reports, the BWSSB shall provide detailed Good for construction drawings for implementation of these works. Based on these GFC's, the contractor has to submit the detail approach and method statement for the construction of GLR, OHT, service station, chlorination building, pipeline execution and other allied works. The method statement will be reviewed and approved by Employer. After approval of this method statement any addition or deletion in scope of works will be freezed by the employer.

4 The CONTRACTOR shall be deemed to have visited and carefully examined the site and surroundings and to have satisfied himself about the nature of the existing structures, general site conditions, the site for disposal of surplus materials, debris etc.(The useful and un-useful surplus materials out of site grading / excavation shall be dumped in their respective specified dump areas) and all other items affecting the work. Claims due to ignorance of site conditions will not be considered after submission of the Bid.

5 The Contractor shall, at his own cost, conduct tests, to ensure the suitability of the proposed fill material. He shall submit the test results to the Owner/Consultant and obtain approval of the same before commencing the site grading operations, and, if required shall make arrangements for the Owner/Consultant to witness sample preparation and conducting of the tests.

1.2 Royalties

1.2.1 The Employer shall deduct Royalties on materials used in the Works from the progress payments to the Contractor at the rates specified in the most recent "Amendment to the Karnataka Minor Minerals Concession Rules - 1969" as published by the Commerce and Industries Department (Mines) and as illustrated in Annexure-1, attached.

1.3 Site Order Book

1.3.1 The Contractor shall maintain an identical pair of Site Order Books (one marked original and the other marked duplicate), at the Site at all times during the execution of the Works for the use of the Engineer and the Contractor. All instructions issued by the Engineer to the Contractor shall be recorded in both sets of the Site Order Book and shall be signed by the issuer and countersigned by the

Contractor. After compliance with the instruction, the Contractor shall record the same in both sets of the Site Order Book duly signed and countersigned by the Engineer. Acceptance of any part of the work executed by the Contractor shall be subject to verification with respect to compliance of respective instructions of the Engineer through the Site Order Book. The Engineer shall retain the original copy of the Site Order Book, while the Contractor shall retain the duplicate one.

2. SITE CLEARANCE (CLEARING AND GRUBBING)

2.0 Scope

This work shall consist of cutting, removing and disposing of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness, rubbish etc., from the area of Works which in the opinion of the Engineer are unsuitable for incorporation in the Works, and such other areas as may be specified on the Drawings or by the Engineer. It shall include necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, and disposal of cleared materials. Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these Specifications.

2.1 Preservation of Property/Amenities

Trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all facilities within or adjacent to the site which are not to be disturbed shall be protected from injury or damage. The Contractor shall provide and install at his own expense, suitable safeguards approved by the Engineer for this purpose.

During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional Works to that effect vide relevant Clauses of section 3 Before start of operations, the Contractor shall submit to the Engineer for approval, his work plan including the procedure to be followed for disposal of waste materials, etc., and the schedules for carrying out temporary and permanent erosion control Works.

2.2 Methods, Tools and Equipment

Only such methods, tools and equipment as are approved by the Engineer and which will not affect the property to be preserved shall be adopted for the Work. If the area has thick vegetation / roots / trees, a crawler or

pneumatic tyred dozer of adequate capacity may be used for clearance purposes. The dozer shall have ripper attachments for removal of tree stumps. All trees, stumps, etc., falling within excavation and fill lines shall be cut to such depth below ground level that in no case these fall within 500 mm of the subgrade / foundation / bed level. Also, all vegetation such as roots, under-growths, grass and other deleterious matter unsuitable for incorporation in the Work shall be removed between fill lines to the satisfaction of the Engineer. On the areas beyond these limits, trees and stumps required to be removed as directed by the Engineer shall be cut down to 1 m below ground level so that these do not present any unsightly appearance.

All branches of trees extending above the roadway shall be trimmed as directed by the Engineer.

All excavations below the general ground level arising out of the removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface as these points conform to the surrounding area.

Ant-hills both above and below the ground, as are liable to collapse and obstruct free subsoil water flow shall be removed and their workings, which may extend to several meters, shall be suitably treated.

2.3 Disposal of Materials

All materials arising from clearing and grubbing operations shall be the property of Employer and shall be disposed of by the Contractor as hereinafter provided or directed by the Engineer.

Trunks and stumps of trees shall be cleaned of limbs and roots and stacked. Also boulders, stones and other materials usable in construction shall be neatly stacked as directed by the Engineer. Stacking stumps, boulders, stones etc., shall be done at specified spots with all lifts and lead.

All products of clearing and grubbing which, in the opinion of the Engineer, cannot be used or auctioned shall be cleared away from the site in a manner as directed by the Engineer. Care shall be taken to see that unsuitable waste materials are disposed off in such a manner that there is no likelihood of these getting mixed up with the materials meant for construction.

2.4 Measurements for Payment

Clearing and grubbing shall be measured on area basis in terms of hectares. Clearing and grubbing of borrow areas shall be deemed to be a part of Works preparatory to embankment construction and shall be deemed to have been included in the rates quoted for the embankment construction item and no separate payment shall be made for the same. Cutting of trees up to 300 mm in girth including removal of stumps and roots, and trimming of branches of trees extending above the roadway shall be considered incidental to the clearing and grubbing operations. Removal of stumps left over after trees have been cut by any other agency shall also be considered incidental to the clearing and grubbing operations.

Cutting, including removal of stumps and roots of trees of girth above 300 mm and backfilling to required compaction shall be measured in terms of number according to the sizes given below:

1. Above 300 mm to 600 mm;

2. Above 600 mm to 900 mm;

3. Above 900 mm to 1800 mm; and

4. Above 1800 mm.

For this purpose, the girth shall be measured at a height of 1 m above ground or at the top of the stump if the height of the stump is less than 1 m from the ground.

2.5 Rates

The Contract unit rates for the various items of clearing and grubbing shall be payment in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work. These will also include removal of stumps of trees less than 300 mm in girth as well as stumps left over after cutting of trees carried out by another agency, excavation and back-filling to required density, where necessary, and handling, salvaging, piling and disposing of the cleared materials with all lifts and leads.

2.5.1 The Contract unit rates for cutting (including removal of stumps and roots) of trees of girth above 300 mm shall include excavation and back-filling to required compaction, handling, salvaging, piling and disposing of the cleared materials with all lifts and lead.

2.5.2 Where a Contract does not include separate items of clearing and grubbing, the same shall be considered incidental to the earthwork

items and the Contract unit prices for the same shall be considered as including clearing and grubbing operations.

3. EARTHWORKS

3.1 Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

a) IS 783 - 1985 - Code of practice for laying of concrete pipes.

b) IS 3764 - 1992 - Excavation work - Code of Safety.

c) IS 2720 - Methods of test for soils:

(Part-1) - 1983 - Preparation of dry soil samples for various tests.

(Part-2) - 1973 - Determination of Water Content.

(Part-4) - 1985 - Grain size analysis.

(Part-5) - 1985 - Determination of liquid and plastic limit.

(Part-7) - 1980 - Determination of water content - dry density relation using light compaction.

(Part-9) - 1992 - Determination of dry density - moisture content relation by constant weight of soil method.

(Part-14) - 1983- Determination of density index (relative density) of Cohesion less soils.

(Part-22) - 1972 - Determination of organic matter.

(Part-26) - 1987 - Determination of pH Value.

(Part-27) - 1987- Determination of total soluble sulphates.

(Part-28) - 1974- Determination of dry density of soils in place, by the sand replacement method.

(Part-33) -1971 - Determination of the density in place by the ring and water replacement method.

(Part-34) - 1972- Determination of density of soil in place by rubber baloon method.

(Part-38) - 1976- Compaction control test (Hilf Method).

3.2 Drawings

Engineer will furnish drawings wherever, in his opinion, such drawings are required to show areas to be excavated/filled grade level, sequence of priorities etc. Contractor shall follow strictly such drawings.

3.3 General

The Contractor shall furnish all tools, plant, instruments, qualified supervisory personnel, labour, materials, any temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein for completion of the work in accordance with the Specifications.

The Contractor shall survey the site before excavation and set out all lines and establish levels for various works such as grading, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference/grid lines at 8m intervals or nearer, if necessary, based on ground profile and thereafter properly recorded.

The excavation shall be carried out to correct lines and levels. This shall also include, where required, proper shoring to maintain excavations and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night.

The rates quoted shall also include for dumping of excavated material in regular heaps, bunds, riprap with regular slopes within the lead specified and levelling the same so as to provide natural drainage. Rock/soil excavated shall be stacked properly as approved by the Engineer. As a rule, all softer material shall be laid along the center of heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

Topsoil shall be stock piled separately for later re-use.

3.4 Clearing

The area to be excavated/filled shall be cleared of fences, trees, plants, logs, stumps, bush, vegetation, rubbish, slush, etc. and other objectionable matter. If any roots or stumps of trees are encountered during excavation, they shall also be removed. The material so removed shall be disposed off as

approved by the Engineer. Where earth fill is intended, the area shall be stripped of all loose/ soft patches, top soil containing objectionable matter/ materials before fill commences.

3.5 Classification

All materials to be excavated shall be classified by Engineer, into one of the following classes and shall be paid for at the rate tendered for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of Engineer regarding the classification of the material shall be final and binding on Contractor and not be a subject matter of any appeal or arbitration.

Any earthwork will be classified under any of the following categories:

a) Ordinary & Hard Soils

These shall include all kinds of soils containing kankar, sand, silt, moorum and/or shingle, gravel, clay, loam, peat, ash, shale, etc., which can generally be excavated by spade, pick axes and shovel, and which is not classified under “soft and decomposed rock” and “hard rock” defined below. This shall also include embedded rock boulders not longer than 1 metre in any one direction and not more than 200 mm in any one of the other two directions.

a) Soft and Decomposed Rock

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite, highly weathered granite gneiss and all other materials which in the opinion of Engineer is rock, but does not need blasting and could be removed readily with picks, hammer, crow bars, wedges, and pneumatic breaking equipment. The mere fact that Contractor resorts to blasting for reasons of his own, shall not qualify for classification under ‘hard rock’.

This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock boulders not longer than 1 metre in any direction and not more than 500 mm in any one of the other two directions. Masonry to be dismantled will also be measured under this item.

b) Hard Rock

This shall include all rock occurring in large continuous masses which cannot be removed except by blasting, chiselling or by drilling with heavy mechanical breakers. Harder varieties of rock with or without veins and secondary minerals which, in the opinion of Engineer require blasting shall

be considered as hard rock. Boulders of rock occurring in such sizes and not classified under (a) and (b) above shall also be classified as hard rock. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item, unless a separate provision is made in the Schedule of Quantities.

Before classification of material as rock the Contractor shall demonstrate to the satisfaction of the Employer's Representative his inability to excavate it without resort to heavy percussion tools complete with rock bits, hydraulic wedges or blasting. Excavation by the use of explosive will not normally be permitted.

Material shall not be classified as rock unless the Employer's Representative has agreed to such classification on the basis of such a demonstration before its excavation. Excavations where rock has been encountered and classified as such shall not be backfilled before examination of the excavated faces by the Employer's Representative to enable the extent of the rock excavation to be determined.

3.6 Excavation

All excavation work shall be carried out by mechanical equipment unless, in the opinion of Engineer, the work involved requires it to be carried out by manual methods.

Excavation for permanent work shall be taken out to such widths, lengths, depths and profiles as are shown on the drawings provided by the Contractor or such other lines and grades as may be agreed with the Engineer. Rough excavation shall be carried out to a depth of 150mm above the final level. The balance shall be excavated with special care. Soft pockets shall be removed below the final level and extra excavation filled up with lean concrete of grade M10 with 40 mm downgraded aggregates as approved by the Engineer. The final excavation should be carried out just prior to laying the blinding course.

Contractor may, for facility of work or similar other reasons excavate, and also backfill later, if so approved by Engineer, at his own cost outside the lines shown on the drawings or directed by Engineer. Should any excavation be taken below the specified elevations, Contractor shall fill it up, with concrete of the same class as in the foundation resting thereon,

upto the required elevation. No extra shall be claimed by Contractor on this account.

All excavations shall be to the minimum dimensions required for safety and ease of working. Prior approval of the Engineer shall be obtained by the Contractor in each individual case, for the method proposed for the excavation, including dimensions, side slopes, dewatering, disposal, etc. This approval shall not in any way relieve the Contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for if the slips are due to the negligence of Contractor.

3.7 Stripping Loose Rock

All loose boulders, detached rocks partially and other loose material which might move therewith not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Engineer, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of Engineer, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed. The cost of such stripping will be paid for at the unit rates accepted for the class of materials in question.

3.8 Excavation in Hard Rock

3.8.1 General Requirements

Unless otherwise stated herein, BIS Specification "IS- 4081(1986) Safety code for Blasting and related Drilling Operations" shall be followed. After removal of overburden, if any, excavation shall be continued in rock to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by the Engineer. As far as

possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions shall be taken to preserve the rock below and beyond the lines specified for the excavation, in the soundest possible condition. The quantity and strength of explosive used shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by the Engineer, shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structure as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of the Engineer at his cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.

Specific permission of the Engineer will have to be taken by Contractor for blasting rock and he shall also obtain a valid Blasting License from the authorities concerned. If permission for blasting is refused by the Engineer, the rock shall be removed by wedging, pick, barring, heating and quenching or other approved means. All loose or loosened rock in the sides shall be removed by barring, wedging, etc. The unit rate for excavation in hard rock shall include the cost of all these operations.

Contractor shall obtain necessary licence for storage of explosives, fuses and detonators issued to him from Employer's stores or from supplier arranged by him, from the authorities dealing with explosives. The fees, if any, required for obtaining such license, shall be borne by Contractor. Contractor shall have to make necessary storage facilities for the explosives etc. as per rules of local, State and Central Government authorities and Statutory bodies/regulations. Explosives shall be kept dry and shall not be exposed to direct rays of sun or be stored in the vicinity of fire, stoves, steam pipes or heated metal, etc. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done; and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as for as possible away from the area to be blasted, Engineer's prior approval shall be taken for the location proposed for the magazine.

In no case shall blasting be allowed closer than 30 metres to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old.

In the case of water transmission, pipe lines worksetc for water transfer, the following stipulations shall over-ride the corresponding stipulations in "General Requirements" given above:

Excavation in hard rock shall be only by chiseling / Jack hammering or by drilling with mechanical brakers.

The rock shall be removed by wedging, pick, boring, heating and quenching or other approved non-blasting methods. All loose or loosened rock in the sides shall be removed by barring, wedging etc. The unit rate for excavation in hard rock shall include the cost of all these operations. No blasting is allowed.

3.8.2 Specific Requirements

For blasting operations, the following points shall be observed.

Contractor shall employ a competent and experienced supervisor and licensed blaster in-charge of each set of operation, who shall be held personally responsible to ensure that all safety regulations are carried out.

Before any blasting is carried out, Contractor shall intimate Engineer and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.

Contractor shall ensure that all workmen and the personnel at site are excluded from a area within 200 m. radius from the firing point, at least 5 minutes before firing time by sounding warning whistle. The area shall also be given warning by sounding a distinguishing whistle.

The blasting of rock near any existing buildings, equipment or any other property shall be done under cover if permitted by the Engineer and Contractor has to make all such necessary muffling arrangements. Covering may preferably be done by M.S. plates with adequate dead weight over them. Blasting shall be done with small charges only and where directed by Engineer, a trench shall have to be cut by chiseling prior to the blasting operation separating the area under blasting from the existing structures.

The firing shall be supervised by a Supervisor and not more than 6 (six) holes at a time shall be set off successively. If the blasts do not tally with the

number fired, the misfired holes shall be carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.

A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth, the balance of the hole shall be filled with stemming which may consist of sand or stone dust or similar inert material.

Contractor shall preferably detonate the explosives electrically.

The explosives shall be exploded by means of a primer which shall be fired by detonating a fuse instantaneous detonator (F.I.D) or other approved cables. The detonators with F.I.D shall be connected by special nippers.

In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatine with detonator and fuse wire may be used. Under water or for excavation in rock with substantial accumulated seepage electric detonation shall be used.Holes for charging explosive shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.

When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level. Any rock excavation beyond an overbreak limit of 75 mm shall be filled up as instructed by Engineer, with concrete of strength not less than M100. The cost of filling such excess depth shall be borne by Contractor and the excavation carried out beyond the limit specified above will not be paid for. Stopping in rock excavation shall be done by hand trimming.

Contractor shall be responsible for any accident to workmen, public or Employer's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of Explosives, or any other Authority duly constituted under the State and /or Union Government.

3.9 Fill, Backfilling and Site Grading

3.9.1 General

All fill material shall be subject to the Engineer’s approval. If any material is rejected by Engineer, the Contractor shall remove the same forthwith from the site. Surplus fill material shall be deposited/disposed off as directed by Engineer after the fill work is completed.

No earthfill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with to the approval of the Engineer.

The Contractor shall not commence the placement of any fill or backfill at any location without the approval of the Engineer.

3.9.2 Material

To the extent available, selected surplus soils from excavations shall be used as backfill. Backfill material shall be free from lumps, organic or other foreign material. All lumps of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murum or earth to fill the voids and the mixture used for filling.

If fill material is required to be imported, the Contractor shall make arrangements to bring such material from outside borrow pits. The material and source shall be subject to the prior approval of the Engineer. The approved borrow pit areas shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Top soil containing foreign material shall be removed. The materials so removed shall be disposed off as directed by Engineer. The Contractor shall provide the necessary access roads to borrow areas and maintain the same if such roads do not exist, at his cost.

3.9.3 Filling in pits and trenches around foundations of structures, walls, etc.

As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches, etc., shall be cleared of all debris and filled with earth in layers not exceeding 15 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless the Engineer is satisfied that in some cases manual compaction by tampers

cannot be avoided. The final backfill surface shall be trimmed and leveled to a proper profile to the approval of the Engineer.

3.9.4 Plinth Filling

Plinth filling shall be carried out with approved material as described hereinbefore in layers not exceeding 15cm, watered and compacted with mechanical compaction machines. The Engineer may, however, permit manual compaction by hand tampers where he is satisfied that mechanical compaction is not possible. When filling reaches the finished level, the surface shall be flooded with water, unless otherwise directed, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlement at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.

Compaction of the plinth fill shall be carried out by means of 12 ton rollers smooth wheeled, sheep-foot or wobbly wheeled rollers. In case of compaction of granular material such as sands and gravel, vibratory rollers shall be used. A smaller weight roller may be used only if permitted by the Engineer. As rolling proceeds, water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fills.

The thickness of each unconsolidated fill layer can in this case be upto a maximum of 300mm. The Contractor will determine the thickness of the layers in which fill has to be consolidated depending on the fill material and equipment used and the approval of the Engineer obtained prior to commencing filling.

Rolling shall commence from the outer edge and progress towards the centre and continue until compaction is to the satisfaction of Engineer, but in no case less than 10 passes of the roller will be accepted for each layer.

The compacted surface shall be properly shaped, trimmed and consolidated to an even and uniform gradient. All soft spots shall be excavated, then filled and consolidated.

At some locations/areas, it may not be possible to use rollers because of space restrictions, etc. The Contractor shall then be permitted to use pneumatic tampers, rammers, etc. and he shall ensure proper compaction.

3.9.5 Sand Filling in Plinth and Other Places

Where backfilling is required to be carried out with local sand it shall be clean, medium grained and free from impurities. The filled-in-sand shall be

kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be on Contractor's account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the Engineer has inspected and approved the fill.

3.9.6 Filling in Trenches

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the centre line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the centre line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling upto a level 30 cm above the top of the pipe shall be done with fine materials such as earth, murum, etc. The filling up to the level of the centre line of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the centre line of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

In the case of water transmission, pipe lines worksetc for water transfer, the Contractor shall take proper precautions against the risks of floatation. Should any section of the pipeline be affected by floatation in the course of works the entire work shall be removed and then reinstalled to the satisfaction of Engineer.

3.10 General Site Grading

Site grading shall be carried out as indicated in the drawings and as approved by the Engineer. Excavation shall be carried out as specified in the Specifications. Filling and compaction shall be carried out as specified under Clause 3.9 and elsewhere unless otherwise indicated below.

The fill has to be compacted in layers not exceeding 225 mm and levelled uniformly and compacted as indicated in Clause 3.9 before the next layer is deposited.

To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by the Contractor at his cost.

Field compaction tests shall be carried out in each layer of filling until the fill to the entire height has been completed. This shall hold good for embankments as well. The fill will be considered as incomplete if the desired compaction has not been obtained.

The Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, the Contractor shall remove the affected material and make good the slip at his cost.

If so specified, the rock as obtained from excavation may be used for filling and leveling to indicated grades without further breaking. In such an event, filling shall be done in layers not exceeding 50 cms approximately. After rock filling to the approximate level, indicated above has been carried out, the void in the rocks shall be filled with finer materials such as earth, broken stone, etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken material and earth shall be laid and consolidation carried out by a 12 ton roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

3.11 Fill Density

The compaction, where so called for, shall comply with minimum 95% Modified Proctor density at moisture content differing not more than 4% from the optimum moisture content. The Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained.

3.12 Lead

Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. No extra compensation is admissible on the grounds that the lead including that for borrowed material had to be transported over marshy or 'katcha' land/route.

3.13 Measurement and Payment

All excavation shall be measured nett. Dimensions for purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, tanks, rafts or other foundations/structures to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. Excavations in side slopes will not be paid for. Contractor may make such allowance in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety or excavation. Reasonable working space, beyond concrete dimensions and shuttering where considered necessary in the opinion of Engineer will be allowed in excavation and considered for payment. However, if concreting is proposed against the excavated sides, no such over-excavation will be permitted. In such cases over-excavation shall be made good by Contractor with concrete of the same class as in the foundations at his cost.

In the case of water transmission, pipe lines worksetc for water transfer trench excavation shall be measured using the dimensions detailed in the standard section shown on the Drawings. No payment will be made for working space except where clearly mentioned on the drawings. Excavation beyond the widths or depths required will not be paid for any additional concrete or bedding material required as a result of over-excavation at the Contractor's expense.

Backfilling as per specification the sides of foundations of columns, footings, structures, walls, tanks, rafts, trenches etc. with excavated material will not be paid for separately. It shall be clearly understood that the rate quoted for excavation including backfilling shall include stacking of excavated material as directed, excavation/packing of selected stacked material, conveying it to the place of final backfill, compaction etc. as specified. As a rule material to be backfilled shall be stacked temporarily within the basic

lead of 100 metres unless otherwise directed by the Engineer. If Engineer directs/permits a lead of over 100 metres for such material, the conveyance of the material for the extra distance over the basic lead of 100 metres for backfilling will be paid for.

Payment for fill inside trenches, plinth or similar filling with selected excavated material will be made for only compaction as specified/directed. Cost of all other operations shall be deemed to have been covered in the rate quoted for excavation. Payment for this work will be made based on measurement of plinth/trench dimensions as per drawings. The plinth ground levels shall be surveyed before hand for this purpose. If no compaction is specified/desired such filling will not be separately paid for. In such an event the fill shall be leveled/finished to the profile as directed at no extra cost.

Backfilling, plinth filling etc. with borrowed earth will be paid for at rates quoted. The quoted rate shall include all operations such as clearing, excavation, lead and transport, fill, compaction etc, as specified. Actual quantity of consolidated filling or actual quantity or excavation in the borrow pits (less such top soil which has been excavated and not used for filling) whichever is less shall be measured and paid for in cubic metres. The lead, lift etc. shall be as indicated in the schedule of quantities.

Actual quantity of consolidated sand filling shall be measured and paid in cubic metres.

Volume of rock excavated shall be calculated on the basis of length, breadth and depth of excavation indicated on the drawings. No payment will be made for excavations/overbreak beyond payment line specified. Where such measurement is not possible as in the case of strata intermixed with soil, excavated rock shall be properly stacked as directed by Engineer and the volume of rock calculated on the basis of stack measurements after making appropriate allowance for voids. The allowance to be made for voids shall be decided by Engineer and this will not be a subject matter of dispute or appeal.

3.14 Timber Shoring

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as approved by

the Engineer. The boards shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal walings of strong wood at maximum 1.2 metre spacings, strutted with ballies or as approved by the Engineer. The length of the ballie struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical walings, which in turn shall be suitably strutted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by the Engineer. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of excavations, trenches, pits, etc. from collapsing.

Timber shoring may also be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only under instructions from the Engineer.

The withdrawal of the timber shall be done carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded with, systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber.

In the case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacings shall be subject to the approval of the Engineer. In all other respects, the Specifications for close timbering shall apply to open timbering.

In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided.

The load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut. If however, Engineer directs any timbering to be left-in, keeping in mind the type of construction or any other factor, Contractor shall be paid for at the scheduled item rate for such left-in timbering.

3.14 Measurement

Unless separately provided for in the Schedule of Quantities, the actual effective area of shored faces as approved by Engineer shall be measured in sq.m. The area of planking embedded in the bed/sides of excavation will not be considered, nor the area supporting inclined struts in case of large pits/open excavation. All planks, boards, walings, verticals, struts, props and all other materials required for shoring and subsequent safe dismantling and removal shall be included in the quoted unit rates.

3.15 Dewatering

The Contractor shall ensure that the excavation and the structures are free from water during construction and shall take all necessary precautions and measures to exclude ground/rain water so as to enable the works to be carried out in reasonably dry conditions in accordance with the construction programme. Sumps made for dewatering must be kept clear of the excavations/trenches required for further work. The method of pumping shall be approved by Engineer, but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction. The dewatering shall be continued for at least (7) seven days after the last pour of the concrete. The Contractor shall, however, ensure that no damage to the structure results on stopping of dewatering.

The Contractor shall study the sub-soil conditions carefully and shall conduct any tests necessary at the site with the approval of the Engineer to test the permeability and drainage conditions of the sub-soil for excavation, concreting etc., below ground level.

The scheme for dewatering and disposal of water shall be approved by the Engineer. The Contractor shall suitably divert the water obtained from dewatering from such areas of site where a build up of water in the opinion of the Engineer obstructs the progress of the work, leads to insanitary

conditions by stagnation, retards the speed of construction and is detrimental to the safety of men, materials, structures and equipment.

When there is a continuous inflow of water and the quantum of water to be handled is considered in the opinion of Engineer, to be large, a well point system- single stage or multistage, shall be adopted. The Contractor shall submit to the Engineer, details of his well point system including the stages, the spacing, number and diameter of well points, headers etc., and the number, capacity and location of pumps for approval. Unless separately provided for in the Schedule of prices, the cost of dewatering shall be included in the item rate for excavation.

3.16 Measurement

Unless separately provided for in the Schedule of quantities, dewatering is deemed to have been included in the unit rates quoted for excavation. If separately provided for, the unit of measurement shall be as indicated in the Schedule of Quantities.

3.17 Rain Water Drainage

Grading in the vicinity of excavation shall be such as to exclude rain/ surface water draining into excavated areas. Excavation shall be kept clean of rain and such water as the Contractor may be using for his work by suitably pumping out the same. The scheme for pumping and discharge of such water shall be approved by the Engineer.

3.18 Earthen Embankment Construction

3.19.1 Scope

These Specifications shall apply to the construction of embankments including sub grades, earthen shoulders and miscellaneous backfills with approved materials obtained from roadway and drain excavation, borrow pits or other sources. All embankments, subgrade, earthen shoulders and miscellaneous backfills shall be constructed in accordance with the requirements of these Specifications and in conformity with the lines, grades, and cross-sections shown on the Drawings or as directed by the Engineer.

3.19.2 Physical Requirements of materials

The materials used in embankments, sub grades, earthen shoulders and miscellaneous backfills shall be soil, moorum, gravel, a mixture of those or

any other material approved by the Engineer. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the embankment/subgrade.

The following types of material shall be considered unsuitable for embankment:

Materials from swamps, marshes and bogs;

Peat, log, stump and perishable material; any soil that classifies as OL, OI, OH or Pt in accordance with IS: 1498.

Materials susceptible to spontaneous combustion;

Materials in a frozen conditions;

Clay having liquid limit exceeding 70 and plasticity index exceeding 45; and

Materials with salts resulting in leaching in the embankment.

Expansive clay exhibiting marked swell and shrinkage properties (“free swelling index” exceeding 50 percent when tested as per IS: 2720 Part 40) shall not be used as a fill material. Where expansive clay with acceptable “free swelling index” value is used as a fill material, subgrade and top 500 mm portion of the embankment just below subgrade shall be non-expansive in nature.

Any fill material with a soluble sulphate content exceeding 1.9 grams of sulphate (expressed as SO3) per litre when tested in accordance with BS: 1377 Test 10, but using a 2:1 water-soil ratio shall not be deposited within 500 mm or other distance described in the Contract, of concrete, cement bound materials or other cementitious materials forming part of the Permanent Works.

Materials with a total sulphate content (expressed as SO3) exceeding 0.5 percent by mass, when tested in accordance with BS: 1377 Test 9 shall not be deposited within 500 mm, or other distances described in the Contract, of metallic items forming part of the Permanent Works.

The size of the coarse material in the mixture of earth shall ordinarily not exceed 75 mm when being placed in the embankment and 50 mm when placed in the subgrade. However, the Engineer may at his discretion permit the use of material coarser than this also if he is satisfied that the same will not present any difficulty as regards the placement of fill material and its compaction to the requirements of these Specifications. The maximum

particle size shall not be more than two-thirds of the compacted layer thickness.

Ordinarily, only the materials satisfying the density requirements given in Table 5-3 shall be employed for the construction of the embankment and the subgrade.

Table-I. Density Requirements of Embankment and Subgrade Materials

Sr.	Type of Work	Maximum laboratory dry unit weight when tested as per IS: 2720 (Part 8)
1.	Embankments up to 3 metres height, not subjected to extensive flooding.	Not less than 15.2 kN/cum.
2.	Embankments exceeding 3 metres height or embankments of any height subject to long periods of inundation	Not less than 16.0 kN/cum.
3.	Sub grades and earthen shoulders / verges / backfill	Not less than 17.5 kN/cum.

Notes:

This Table is not applicable for lightweight fill material e.g. cinder, fly ash etc.

The Engineer may relax these requirements at his discretion taking into account the availability of materials for construction and other relevant factors.

The material to be used in subgrade should also satisfy design CBR at the dry unit weight applicable as per Table-II.

3.19.3 General requirements of materials

The materials for embankment shall be obtained from approved sources with preference given to materials becoming available from nearby roadway excavation or any other excavation under the same Contract.

The work shall be so planned and executed that the best available materials are saved for the subgrade and the embankment portion just below the subgrade.

3.19.3.1 Borrow Materials

Where the materials are to be obtained from designated borrow areas, the location, size and shape of these areas shall be as indicated by the Engineer and the same shall not be opened without his written permission. Where specific borrow areas are not designated by the Employer / the Engineer, arrangement for locating the source of supply of material for embankment and subgrade as well as compliance to environmental requirements in respect of excavation and borrow areas as stipulated, from time to time by the Ministry of Environment and Forests, Government of India and the local bodies, as applicable, shall be the sole responsibility of the Contractor.

Borrow pits along the road shall be discouraged. If permitted by the Engineer, these shall not be dug continuously. Ridges of not less than 8 m width should be left at intervals not exceeding 300 m. Small drains shall be cut through the ridges to facilitate drainage. The depth of the pits shall be so regulated that their bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of the bank, the maximum depth in any case being limited to 1.5 m. Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10 m.

Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plants is operating at the place of deposition.

No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Should the Contractor be permitted to remove acceptable material from the site to suit his operational

procedure, then he shall make good any consequent deficit of material arising there from.

Where the excavation reveals a combination of acceptable and unacceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials. The acceptable materials shall be stockpiled separately.

The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme approved by the Engineer. It shall be ensured that the subgrade material when compacted to the density requirements as in Table II shall yield the design CBR value of the subgrade.

Table-II . Compaction Requirements for Embankment and Subgrade

Sr	Type of work/ material	Relative compaction as percentage of max. laboratory dry density as per IS: 2720 (Part 8)
1.	Subgrade and earthen shoulders	Not less than 97
2.	Embankment	Not less than 95
3.	Expansive Clays	
	a) Subgrade and 500 mm portion just below the subgrade	Not allowed
	b) Remaining portion of embankment	Not less than 90

The Contractor shall at least 7 working days before commencement of compaction submit the following to the Engineer for approval:

The values of maximum dry density and optimum moisture content obtained in accordance with IS: 2720 (Part 7) or (Part 8), as the case may be, appropriate for each of the fill materials he intends to use.

A graph of density plotted against moisture content from which each of the values in (1) above of maximum dry density and optimum moisture content were determined.

The Dry density-moisture content-CBR relationships for light, intermediate and heavy compactive efforts (light corresponding to IS: 2720 (Part 7), heavy corresponding to IS: 2720 (Part 8) and intermediate in-between the two) for each of the fill materials he intends to use in the subgrade.

Once the above information has been approved by the Engineer, it shall from the basis for compaction.

3.19.4 Construction Operations for Embankments

3.19.4.1 Setting out

After the site has been cleared , the work shall be set out. The limits of embankment/subgrade shall be marked by fixing batter pegs on both sides at regular intervals as guides before commencing the earthwork. The embankment / subgrade shall be built sufficiently wider than the design dimension so that surplus materials may be trimmed, ensuring that the remaining material is to the desired density and in position specified and conforms to the specified side slopes.

3.19.4.2 Dewatering

If the foundation of the embankment is in an area with stagnant water, and in the opinion of the Engineer it is feasible to remove it, the same shall be removed by bailing out or pumping, as directed by the Engineer and the area of the embankment foundation shall be kept dry. Care shall be taken to discharge the drained water so as not to cause damage to the works, crops or any other property. Due to any negligence on the part of the Contractor, if any such damage is caused, it shall be the sole responsibility of the Contractor to repair / restore it to original condition or compensate the damage at his own cost. If the embankment is to be constructed under Water, Clause 3.19.5 shall apply.

3.19.4.3 Stripping and Storing topsoil

In localities where most of the available embankment materials are not conducive to plant growth, or when so directed by the Engineer, the topsoil

from all areas of cutting and from all areas to be covered by embankment foundation shall be stripped to specified depths not exceeding 150 mm and stored in stockpiles of height not exceeding 2 m for covering embankment slopes, cut slopes and other disturbed areas where re-vegetation is desired. Topsoil shall not be unnecessarily trafficked either before stripping or when in a stockpile. Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum.

3.19.4.4 Compacting ground supporting Embankment / Subgrade

When necessary, the original ground shall be leveled to facilitate placement of first layer of embankment, scarified, mixed with water and then compacted by rolling so as to achieve minimum dry density as given in Table-II.

In case where the difference between the subgrade level (top of the subgrade on which pavement rests) and ground level is less than 0.5 m and the ground does not have 97 percent relative compaction with respect to the dry density as given in Table 5-4, the ground shall be loosened up to a level 0.5 m below the subgrade level, watered and compacted in layers in accordance with Clause 3.19.4 to not less than 97 percent of dry density as given in Table-II.

Where so directed by the Engineer, any unsuitable material occurring in the embankment foundation shall be removed and replaced by approved materials laid in layers to the required degree of compaction.

Embankment or subgrade work shall not proceed until the foundations of embankments/subgrade have been inspected by the Engineer for satisfactory condition and approved.

Any foundation treatment specified for embankments especially high embankments, resting on suspect foundations as revealed buy borehole logs shall be carried our in a manner and to the depth as desired by the Engineer. Where the ground on which and embankment is to be built has any of the material types specified in Clause 3.19.2, at least 500 mm of such material must be removed and replaced by acceptable fill material before embankment construction commences.

3.19.4.5 Spreading material in layers and bringing to appropriate moisture content

The embankment and subgrade material shall be spread in layers of uniform thickness not exceeding 200 mm compacted thickness over the entire width of embankment by mechanical means, finished by a motor grader and compacted as per Clause 3.19.4. The motor grader blade shall have hydraulic control suitable for initial adjustment and maintain the same so as to achieve the specific slope and grade. Successive layers shall not be placed until the layer under construction has been thoroughly compacted to the specified requirements as in Table-II and got approved by the Engineer. Each compacted layer shall be finished parallel to the final cross-section of the embankment.

Moisture content of the material shall be checked at the site of placement prior to commencement of compaction; if found to be out of agreed limits, the same shall be made good. Where water is required to be added in such construction, water shall be sprinkled from a water tanker fitted with sprinkler capable of applying water uniformly with a controllable rate of flow to variable widths of surfaces but without any flooding. The water shall be added uniformly and thoroughly mixed in soil by blading, discing or harrowing until and uniform moisture content is obtained throughout the depth of the layer.

If the; material delivered to the roadbed is too wet, it shall be dried, by aeration and exposure to the sun, till the; moisture content is acceptable for compaction. Should circumstances arise, where owing to wet weather, the moisture content cannot be reduced to the required amount by the above procedure, compaction work shall be suspended.

Moisture content of each layer of soil shall be checked in accordance with IS: 2720 (Part 2), and unless otherwise mentioned, shall be so adjusted, making due allowance for evaporation losses, that at the time of compaction it is in the range of 1% above to 2% below the optimum moisture content determined in accordance with IS: 2720 (Part 7) or IS: 2720 (Part 8) as the case may be. Expansive clays shall, however, be compacted at moisture content corresponding to the specified dry density, but on the wet side of the optimum moisture content obtained from the laboratory compaction curve.

After adding the required amount of water, the soil shall be processed by means of graders, harrows, rotary mixers or as otherwise approved by the Engineer unit the layer is uniformly wet.

Clods or hard lumps of earth shall be broken to have a maximum size of 75 mm when being placed in the embankment and a maximum size of 50 mm when being placed in the subgrade.

Embankment and other areas of fill shall, unless otherwise required in the Contract or permitted by the Engineer, be constructed evenly over their full width and their fullest possible extent and the Contractor shall control and direct construction plant and other vehicular traffic uniformly over them. Damage by construction plant and other vehicular traffic shall be made good by the Contractor with material having the same characteristics and strength as the material had before it was damaged.

Embankments and other areas of unsupported fills shall not be constructed with steeper side slopes, or to greater widths than those shown in the Contract, except to permit adequate compaction at the edges before trimming back, or to obtain the final profile following any settlement of the fill and the underlying material.

Whenever fill is to be deposited against the face of a natural slope, or sloping earthworks face including embankments, cuttings, other fills and excavations steeper than 1 vertical on 4 horizontal, such faces shall be benched as per Clause 3.19.5 immediately before placing the subsequent fill.

All permanent faces of side slopes of embankments and other areas of fill formed shall, subsequent to any trimming operations, be reworked and sealed to the satisfaction of the Engineer by tracking a tracked vehicle, considered suitable by the Engineer, on the slope or any other method approved by the Engineer.

3.19.4.6 Compaction

Only the compaction equipment approved by the Engineer shall be employed to compact the different material types encountered during construction. Smooth wheeled, vibratory, pneumatic tyred, sheep foot or pad foot rollers, etc., of suitable size and capacity as approved by the Engineer shall be used for the different types and grades of materials required to be compacted either individually or in suitable combinations.

The compaction shall be done with the help of vibratory roller of 80 to 100 kN static weight with plain or pad foot drum or heavy pneumatic tyred roller of adequate capacity capable of achieving required compaction.
The Contractor shall demonstrate the efficiency of the equipment he intends to use by carrying out compaction trials. The procedure to be adopted for these site trials shall first be submitted to the Engineer for approval.

Earthmoving plant shall not be accepted as compaction equipment nor shall the use of a lighter category of plant to provide any preliminary compaction to assist the use of heavier plant be taken into account.
Each layer of the material shall be thoroughly compacted to the densities specified in Table 5-4. Subsequent layers shall be placed only after the finished layer has been tested according to Clause 903.2.2 of MoST Specifications for Roads and Bridge Works (IV Revision) and accepted by the Engineer. The Engineer may permit measurement of field dry density by a nuclear moisture / density gauge used in accordance with agreed procedure and the gauge is calibrated to provide results identified to that obtained from tests in accordance with IS: 2720 (Part 28). A record of the same shall be maintained by the Contractor.
When density measurement reveal any soft areas in the embankment / subgrade / earthen shoulders, further compaction shall be carried out as directed by the Engineer. If inspite of that the specified compaction is not achieved, the material in the soft areas shall be removed and replaced by approved material, compacted to the density requirements and satisfaction of the Engineer.

3.19.4.7 Drainage

The surface of the embankment / subgrade at all times during construction shall be maintained at such a cross fall (not flatter than that required for effective drainage of an earthen surface) as will shed water and prevent ponding.

3.19.4.8 Repairing of damages caused by rain / spillage of water

The soil in the affected portion shall be removed in such areas as directed by the Engineer before next layer is laid and refilled in layers and compacted using appropriate mechanical means such as small vibratory

roller, plate compactor or power rammer to achieve the required density in accordance with Clause 3.19.5. If the cut is not sufficiently wide for use of required mechanical means for compaction, the same shall be widened suitably to permit their use for proper compaction. Tests shall be carried out as directed by the Engineer to ascertain the density requirements of the repaired area. The work of repairing the damages including widening of the cut, if any, shall be carried out by the Contractor at his own cost, including the arranging of machinery / equipment for the purpose.

3.19.4.9 Finishing operations

Finishing operations shall include the work of shaping and dressing the shoulders / verge / roadbed and side slopes to conform to the alignment, levels, cross-sections and dimensions shown on the Drawings or a directed by the Engineer subject to the surface tolerance described in **Clause 902** of MoST Specifications for Roads and Bridge Works (IV Revision). Both the upper and lower ends of the side slopes shall be rounded off to improve appearance and to merge the embankment with the adjacent terrain.

The topsoil, removed and conserved earlier shall be spread over the fill slopes as per directions of the Engineer to facilitate the growth of vegetation. Slopes shall be roughened and moistened slightly prior to the application of the topsoil in order to provide satisfactory bond. The depth of the topsoil shall be sufficient to sustain plant growth, the usual thickness being from 75 mm to 150 mm.

Where directed, the slopes shall be turfed with sods in accordance with Clause 3.20. If seeding and mulching of slopes is prescribed, this shall be done to the requirement of Clause 3.21.

When earthwork operations have been substantially completed, the road area shall be cleared of all debris, and ugly scars in the construction area responsible for objectionable appearance eliminated.

3.19.5 Construction of Embankment and Subgrade under Special Conditions

3.19.5.1 Earthwork for widening existing road embankment

When an existing embankment and / or subgrade is to be widened and its slope are steeper than 1 vertical on 4 horizontal, continuous horizontal benches, each at least 300 mm wide, shall be cut into the old slope for ensuring adequate bond with the fresh embankment / subgrade material to

be added. The material obtained from cutting of benches could be utilized in the widening of the embankment / subgrade. However, when the existing slope against which the fresh material is to be placed is flatter than 1 vertical on 4 horizontal, the slope surface may only be ploughed or scarified instead of resorting to benching.

Where the width of the widened portions is insufficient to permit the use of conventional rollers, compaction shall be carried out with the help of small vibratory rollers / plate compactors / power rammers of any other appropriate equipment approved by the Engineer. End dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other types of hauling equipment.

3.19.5.2 Earthwork for embankment and subgrade to be placed against sloping ground:

Where an embankment / subgrade is to be placed against sloping ground, the latter shall be appropriately benched or ploughed / scarified as required in Clause 3.19.5before placing the embankment / subgrade material. Extra earthwork involved in benching or due to ploughing/ scarifying etc. shall be considered incidental to the work.

For wet conditions, benches with slightly inward fall subsoil drains at the lowest point shall be provided as per the Drawings, before the fill is placed against sloping ground.

3.19.5.3 Earthwork over existing road surface:

Where the embankment is to be placed over an existing road surface, the work shall be carried out as indicated below:

If the existing road surface is of granular or bituminous type and lies within 1 m of the new subgrade level, the same shall be scarified to a depth of 50 mm or more if specified, so as to provide ample bond between the old and new material ensuring that at least 500 mm portion below the top of new subgrade level is compacted to the desired density.

If the existing road surface is of cement concrete type and lies within 1 m of the new subgrade level the same shall be removed completely.

If the level difference between the existing road surface and the new formation level is more than 1 m, the existing surface shall be permitted to

stay in place without any modification.

3.19.5.4 Embankment and subgrade around structures:

To avoid interference with the construction of abutments, wing walls or return walls of culvert / bridge structures, the Contractor shall, at points to be determined by the Engineer suspend work on embankment forming approaches to such structures, until such time as the construction of the latter is sufficiently advanced to permit the completion of approaches without the risk of damage to the structure.

Unless directed otherwise, the filling around culverts, bridges and other structures up to a distance of twice the height of the road from the back of the abutment shall be carried out independent of the work on the main embankment. The fill material shall not be placed against any abutment or wing wall, unless permission has been given by the Engineer but in any case not until the concrete or masonry has been in position for 14 days. The embankment and subgrade shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement in equal layers on each side of the structure to avoid displacement and unequal pressure. The sequence of work in this regard shall be got approved from the Engineer.

The material used for backfill shall not be an organic soil or highly plastic clay having plasticity index and liquid limit more than 20 and 40 respectively when tested according to IS: 2720 (Part 5). Filling behind abutments and wing walls for all structures shall conform to the general guidelines given in Appendix 6 of IRC:78 (Standard Specifications and Code of Practice for Road Bridges-Section VII) in respect of the type of material, the extent of backfill, its laying and compaction etc. The fill material shall be deposited in horizontal layers in loose thickness and compacted thoroughly to the requirements of Table-II**.**

Where the provision of any filter medium is specified behind the abutment, the same shall be laid in layers simultaneously with the laying of fill material. The material used for filter shall conform to the requirements for filter medium spelt out in Clause 2502of MoST Specifications for Roads and Bridge Works (IV Revision) unless otherwise specified in the Contract.

Where it may be impracticable to use conventional rollers, the compaction shall be carried out by appropriate mechanical means such as small vibratory roller, plate compactor or power rammer. Care shall be taken to

see that the compaction equipment does not hit or come too close to any structural member so as to cause any damage to them or excessive pressure against the structure.

3.19.5.5 Construction of Embankment over Ground Incapable of Supporting Construction Equipment:

Where embankment is to be constructed across ground which will not support the weight of repeated heavy loads of construction equipment, the first layer of the fill may be constructed by placing successive loads of material in a uniformly distributed layer of a minimum thickness required to support the construction equipment as permitted by the Engineer. The Contractor, if so desired by him, may also use suitable geosynthetic material to increase the bearing capacity of the foundation. This exception to normal procedure will not be permitted where, in the opinion of the Engineer, the embankments could be constructed in the approved manner over such ground by the use of lighter or modified equipment after proper ditching and drainage have been provided. Where this exception is permitted, the selection of the material and the construction procedure to obtain an acceptable layer shall be the responsibility of the Contractor. The cost of providing suitable traffic conditions for construction equipment over any area of the Contract will be the responsibility of the Contractor and no extra payment will be made to him. The remainder of the embankment shall be constructed as specified in Clause 3.19.4.

3.19.5.6 Embankment construction under water

Where filling or backfilling is to be placed under water, only acceptable granular material or rock shall be used unless otherwise approved by the Engineer. Acceptable granular material shall consist of graded, hard durable particles with maximum particle size not exceeding 75 mm. The material should be non-plastic having uniformity coefficient of not less than 10. The material placed in open water shall be deposited by end tipping without compaction.

3.19.5.7 Earthwork for high embankment

In the case of high embankments, the Contractor shall normally use the material from the specified borrow area. In case he desires to use different material for his own convenience, he shall have to carry out necessary soil

investigations and redesign the high embankment at his own cost. The Contractor shall then furnish the soil test data and design of high embankment for approval of the Engineer, who reserve the right to accept or reject it.

If necessary, stage construction of fills and any controlled rates of filling shall be carried out in accordance with the Contract including installation of instruments and its monitoring.

Where required, the Contractor shall surcharge embankments or other areas of till with approved material for the periods specified in the Contract. If settlement of surcharged fill results in any surcharging material, which is unacceptable for use in the fill being surcharged, lying below formation level, the Contractor shall remove the unacceptable material and dispose it as per direction of the Engineer. He shall then bring the resultant level up to formation level with acceptable material.

3.19.5.8 Settlement period

Where settlement period is specified in the Contract, the embankment shall remain in place for the required settlement period before excavating for abutment, wingwall, retaining wall, footings, etc., or driving foundation piles. The duration of the required settlement period at each location shall be as provided for in the Contract or as directed by the Engineer.

3.19.6 Plying of Traffic

Construction and other vehicular traffic shall not use the prepared surface of the embankment and / or subgrade without the prior permission of the Engineer. Any damage arising out of such use shall, however, be made good by the Contractor at his own expense as directed by the Engineer.

3.19.7 Surface Finish and Quality Control of Work

The surface finish of construction of subgrade shall conform to the requirements of Clause 902 of MoST Specifications for Roads and Bridge Works (IV Revision). Control on the quality of materials and works shall be exercised in accordance with Clause 903 of MoST Specifications for Roads and Bridge Works (IV Revision).

3.19.8 Subgrade Strength

It shall be ensured prior to actual execution that the borrow area material to be used in the subgrade satisfies the requirements of design CBR.

Subgrade shall be compacted and finished to the design strength consistent with other physical requirements. The actual laboratory CBR values of constructed subgrade shall be determined on undisturbed samples cut out from the compacted subgrade in CBR mould fitted with cutting shoe or on remoulded samples, compacted to the field density at the field moisture content.

3.19.9 Measurements for Payment

Earth embankment/subgrade construction shall be measured separately by taking cross sections at intervals in the original position before the work starts and after its completion and computing the volumes of earthwork in cubic metres by the method of average end areas.

The measurement of fill material from borrow areas shall be the difference between the net quantities of compacted fill and the net quantities of suitable material brought from roadway and drainage excavation. For this purpose, it shall be assumed that one cum. of suitable material brought to site from road and drainage excavation forms one cum. of compared fill and all bulking or shrinkage shall be ignored.

Construction of embankment under water shall be measured in cum.

Construction of high embankment with specified material and in specified manner shall be measured in cum.

Stripping including storing and reapplication of topsoil shall be measured in cum.Work involving loosening and recompacting of ground supporting embankment / subgrade shall be measured in cum.

Removal of unsuitable material at embankment / subgrade foundation and replacement with suitable material shall be measured in cum.

Scarifying existing granular / bituminous road surface shall be measured in square metres.

Dismantling and removal of existing cement concrete pavement shall measured vide Clause 202.6 of MoST Specifications for Roads and Bridge Works (IV Revision).

Filter medium and backfill material behind abutments, wing walls and other retaining structures shall be measured as finished work in position in cum.

3.19.10 Rates

The Contract unit rates for the items of embankment and subgrade construction shall be payment in full for carrying out the required

operations including full compensation for:

Cost of arrangement of land as a source of supply of material of required quantity for construction unless provided otherwise in the Contract;

Setting out;

Compacting ground supporting embankment / subgrade except where removal and replacement of unsuitable material or loosening and recompacting is involved;

Scarifying or cutting continuous horizontal benches 300 mm wide on side slopes of existing embankment and subgrade as applicable;

Cost of watering or drying of material in borrow areas and / or embankment and subgrade during construction as required.

Spreading in layers bringing to appropriate moisture content and compacting to Specification requirements;

Shaping and dressing top and slopes of the embankment and subgrade including rounding of corners;

Restricted working at sites of structures;

Working on narrow width of embankment and subgrade;

Excavation in all soils from borrow pits / designated borrow areas including clearing and grubbing and transporting the material to embankment and subgrade site with all lifts and leads unless otherwise provided for in the Contract;

All labour, materials, tools, equipment and incidentals necessary to complete the work to the Specifications;

Dewatering; and Keeping the embankment / completed formation free of water as per Clause 5.25.

In case the Contract unit rate specified is not inclusive of all leads, the unit rate for transporting material beyond the initial lead, as specified in the Contract for construction of embankment and subgrade shall be inclusive of full compensation for all labour, equipment, tools and incidentals necessary on account of the additional haul or transportation involved beyond the specified initial lead.

The Contract unit rate for scarifying existing granular / bituminous road surface shall be payment in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work. This will also comprise of

handling, salvaging, stacking and disposing of the dismantled materials within all lifts and up to a lead of 1000 m or as otherwise specified.

Clause 202.7 of MoST Specifications for Roads and Bridge Works (IV Revision) shall apply as regards Contract unit rate for dismantling and removal of existing cement concrete pavement.

The Contract unit rate for providing and laying filters material behind abutments shall be payment in full for carrying out the required operations including all materials, labour, tools, equipment and incidentals to complete the work to Specifications.

Clause 3.19.5 shall apply as regards Contract unit rate for construction of embankment under water.

Clause 3.19.5 shall apply as regards Contract unit rate for construction of high embankment. It shall include cost of instrumentation, its monitoring and settlement period, where specified in the Contract or directed by the Engineer.

3.20 Soil Erosion and Sedimentation Control

3.20.1 Scope

This work shall consist of measures as shown on plans or as directed by the Engineer to control soil erosion, sedimentation and water pollution, through use of berms, dikes, sediment basins, fibre mats, mulches, grasses, slope drains, and other devices.

3.20.2 Materials

All materials shall meet commercial grade standards and shall be approved by the Engineer before being used in the work.

3.20.3 Construction Operations

Prior to the start of the relevant construction, the Contractor shall submit to the Engineer for approval his schedules for carrying out temporary and permanent erosion / sedimentation control works as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment / subgrade construction, bridges and other structures across water course, pavement courses and shoulders. He shall also submit for approval his proposed method of erosion / sedimentation control on service road and borrowpits and his plan for disposal of waste materials. Work shall not be started until the erosion / sedimentation control schedules and methods of operations for the applicable construction have been approved

by the Engineer.

The surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations shall be limited to the extent practicable. The Contractor may be directed to provide immediate permanent or temporary erosion and sedimentation control measures to prevent soil erosion and sedimentation that will adversely affect construction operations, damage adjacent properties, or cause contamination of nearby streams or other water courses, lakes, reservoirs etc. Such work may involve the construction of temporary berms, dikes, sediment basins, slope drains and use of temporary mulches, fabrics, mats, seeding, or other control devices or methods as necessary to control erosion and sedimentation. Cut and fill slopes shall be seeded and turfed as required on the plans.

The Contractor shall be required to incorporated all permanent erosion and sedimentation control features into the project at the earliest practicable time as outlined in his accepted schedule to minimize the need for temporary erosion and sedimentation control measures.

Temporary erosion / sedimentation and pollution control measures will be used to control the phenomenon of erosion, sedimentation and pollution that may develop during normal construction practices, but may neither be foreseen during design stage nor associated with permanent control features on the Project.

Where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion or sedimentation control features can follow immediately thereafter if the project conditions permit; otherwise temporary erosion or sedimentation control measure may be required between successive construction stages. Under no conditions shall a large surface area of erodible earth material be exposed at one time by clearing and grubbing or excavation without prior approval of the Engineer.

The Engineer may limit the area of excavation, borrow and embankment operations in progress, commensurate with the Contractor’s capability and progress in keeping the finish grading, mulching, seeding and other such permanent erosion, sedimentation and pollution control measures, in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion / sedimentation control measures shall be taken immediately to the extent feasible and justified.

In the event temporary erosion, sedimentation and pollution control measures become necessary due to the Contractor's negligence, carelessness or failure to install permanent controls as a part of the work as scheduled or ordered by the Engineer, these shall be carried out at the Contractor's own expense. Temporary erosion, sedimentation and pollution control work required, which is not attributed to the Contractor's negligence, carelessness of failure to install permanent controls, will be performed as ordered by the Engineer.

Temporary erosion, sedimentation and pollution control may include construction work outside the right-of-way where such work is necessary as result of road construction such as borrow pit operations, service roads and equipment storage sites.

The temporary erosion, sedimentation and pollution control features installed by the Contractor shall be acceptably maintained by him till these are needed, unless otherwiseagreed by the Engineer.

3.20.4 Measurements for Payment

The soil erosion, sedimentation and pollution control works will be measured in terms of units specified in the Bill of Quantities for the respective items.

3.20.5 Rates

The contract unit rate for different items of soil erosion, sedimentation and pollution control works shall be payment in full for carrying out all required operations including full compensation for all labour, tools, equipment and incidents to complete the works to the Specifications.

3.21 Turfing with Sods

3.21.1 Scope

This work shall consist of furnishing and laying of the live sod of perennial turf forming grass on embankment slopes, verges (earthen shoulders) or other locations shown on the Drawings or as directed by the Engineer. Unless otherwise specified, the work shall be taken up as soon as possible following construction of the embankment, provided the season is

favourable for establishment of the sod.

3.21.2 Materials

The sod shall consist of dense, well-rooted growth of permanent and desirable grasses, indigenous to the locality where it is to be use, and shall be practically free from weeds or other undesirable matter. At the time the sod is cut, the grass on the sod shall have a length of approximately 50 mm and the sod shall have freed of debris.

Thickness of the sod shall be as uniform as possible, with some 50-80 mm or so of soil covering the grass roots depending on the nature of the sod, so that practically all the dense root system of the grasses is retained in the sod strip. The sods shall be cut in rectangular strips of uniform width, not less than about 250 mm X 300 mm in size but not so large that it is inconvenient to handle and transport these without damage. During wet weather, the sod shall be allowed to dry sufficiently to prevent rearing during handling and during dry weather shall be watered before lifting to ensure its vitality and prevent the dropping of the soil in handling.

3.21.3 Construction Operations for Turfing with Sods

Preparation of earth bed

The area to be sodded shall have been previously constructed to the required slope and cross section. Soil on the area shall be loosened, freed of all stones larger than 50 mm size, sticks, stumps and any undesirable foreign matter, and brought to a reasonably fine granular texture to a depth of not less than 25 mm for receiving the sod.

Where required, topsoil shall be spread over the slopes. Prior to placing the topsoil, the slopes shall be scarified to a depth which, after settlement, will provide the required nominal depth shown on the plans. Spreading shall not be done when the ground is excessively wet.

Following soil preparation and top soiling, where required, fertilizer and ground limestone when specified shall be spread uniformly at the rate indicated on the plans. After spreading, the materials are incorporated in the soil by discing or other means to the depths shown on the plans.

Placing the sods

The prepared sod bed shall be moistened to the loosened depth, if not already sufficiently moist, and the sod shall be placed thereon within approximately 24 hours after the same had been cut. Each sod strip shall be laid edge to edge and such that the joints caused by abutting ends are staggered. Every strip, after it is snugly placed against the strips already in position, shall be lightly tamped with suitable wooden or metal tampers so as to eliminate air pockets and to press it into the underlying soil.

On side slopes steeper than 2 (horizontal) to 1 (vertical), the laying of sods shall be started from bottom upwards. At points where water may flow over a sodded area, the upper edges of the sod strips shall be turned into the soil below the adjacent area and a layer of earth placed over this followed by its through compaction.

Staking the sods

Where the side slope is 2 (horizontal) to 1 (vertical) or steeper and the distance along the slope is more than 2 m, the sods shall be staked with pegs or nails spaced approximately 500 to 1000 mm along the longitudinal axis of the sod strips. Stakes shall be driven approximately plumb through the sods to be almost flush with them.

Top dressing

After the sods have been laid in position, the surface shall be cleaned of loose sod, excess soil and other foreign material. Thereafter, a thin layer of topsoil shall be scattered over the surface of top dressing and the area thoroughly moistened by sprinkling with water.

Watering and maintenance

The sods shall be watered by the Contractor for a period of at least four weeks after laying. Watering shall be so done as to avoid erosion and prevent damage to sodded areas by wheels of water tanks.

The Contractor shall erect necessary warning signs and barriers, repair or replace sodded areas failing to show uniform growth of grass or damaged by his operations and shall otherwise maintain the sod at his cost until final acceptance.

Measurement for Payment

Turfing with sods shall be measured as finished work in square metres.

Rate

The Contract unit rate for turfing with sods shall mean payment in full for carrying out all the required operations explained above including compensation for:

Furnishing all the materials to be incorporated in the Works with all leads and lifts; and all labour, tools, equipment and incidental to complete the work in accordance with these Specifications.

3.22 Seeding and Mulching

3.22.1 Scope

This shall consist of preparing slopes, placing topsoil, furnishing all seeds, commercial or organic fertilizers and mulching materials, providing jute netting and placing and incorporation the same on embankment slopes or other locations designated by the Engineer or shown in the Contract documents.

3.22.2 Materials

Seeds

The seeds shall be approved quality and type suitable for the soil on which these are to be applied, and shall have acceptable purity and germination to requirements set down by the Engineer.

Fertilizer

This shall consist of standard commercial materials and conform to the grade specified. Organic manure shall be fully purified organic matter such as cow dung.

Mulching materials

This shall consist of straw, hay wood shavings or sawdust and shall be delivered dry. They shall be reasonably free of weed seed and such foreign materials as may detract from their effectiveness as mulch or be injurious to the plant growth.

Topsoil

Topsoil shall not be obtained from an area known to have noxious weeds growing in it. If treated with herbicides or sterilents, it shall be got tested by appropriate agricultural authority to determine the residual in the soil. Topsoil shall be contain less than 2 per cent and more than 12 per cent organic matter.

Bituminous Emulsion

A suitable grade of bituminous cutback or emulsion used as a tie down for mulch shall be as described in the Contract document or as desired by the Engineer. Emulsified bitumen shall not contain any solvent or diluting agent toxic to plant life.

Netting

Jute netting shall be undyed jute yam woven into a uniform open weave with approximate 2.5 cm square openings. Geonetting shall be made of uniformly extruded rectangular mesh having mesh opening of 2 cm x 2 cm. The colour may be black or green. It shall weigh not less than 3.8 kg per 1000 sq. m.

3.22.3 Seeding Operations

Seed-bed Preparation

The area to be seeded shall be brought to the required slope and cross-section by filling, reshaping eroded areas and refinishing slopes, median etc. Topsoil shall be evenly spread over the specified areas to the depth shown on the plans, unless otherwise approved by the Engineer. The see-bed preparation shall consist of eliminating all live plants by suitable means using agricultural implements. All stones 150 mm in smallest dimension and larger shall be removed. The soil shall be excavated on the contour to a depth of 100 mm. All clods large than 25 mm in diameter shall be crushed and packed. Where necessary, water shall then be applied. All topsoil shall be compacted unless otherwise specified or approved by the Engineer. Compaction shall be by slope compactor, cleated tractor or similar equipment approved by the Engineer. Equipment shall be so designed and constructed as to produce a uniform rough textured surface ready for seeding and mulching and which will bond the topsoil to the underlying material. The entire area shall be covered by a minimum of 4 passes or 2 round trips of the roller or approved equipment.

Fertilizer application

Fertilizer to the required quantities shall be spread and thoroughly incorporated into the soil surface as a part of the seed-bed preparation.

Planting of seeds

All seeds shall be planted uniformly at the approved rate. Immediately after

sowing, the area shall be raked, dragged or otherwise treated so as to cover the seeds to a depth of 6 mm. The operation of seed sowing shall not be performed when the ground is muddy or when the soil or weather conditions would otherwise prevent proper soil preparation and subsequent operations.

Soil Moisture and Watering requirements

Soil moisture shall exist throughout the zone from 25 mm to at least 125 mm below the surface at the time of planting. Watering off the seeded areas shall be carried out as determined by the Engineer.

Mulching, Applying Bituminous Emulsion and Jute Netting / Geonetting

Within 24 hours of seeding, mulching material mixed with organic manure shall be placed so as to form a continuous, unbroken cover of approximate uniform thickness of 25 mm using an acceptable mechanical blower. Mulching material shall be held in place and made resistant to being blown away by suitable means approved by the Engineer. When called for in the Contract documents, mulch material shall be anchored in place with bituminous emulsion applied at the rate of 2300 liters per hectare. Any mulch disturbed or displaced following application shall be removed, reseeded and remulched as specified. Jute netting / Geonetting shall be unrolled and placed parallel to the flow of water immediately following the bringing, to finished grade, the area specified on the plans or the placing of seed and fertilizer. Where more than one strip is required to cover the given areas, they shall overlap a minimum of 100 mm. Jute netting / Geonetting shall be held in place by approved wire staples, pins, spikes or wooden stakes driven vertically into the soil

Maintenance

The Contractor shall maintain all seeded and mulched areas until final acceptance. Maintenance shall include protection of traffic by approved warning signs or barricades and repairing any areas damaged following the seeding and mulching operations. If mulched areas become damaged, the area shall be reshaped and then seeded and mulched again as originally specified.

Measurement for payment

Seeding and mulching shall be measured as finished work in square metres.

Rate

The Contract unit rate for seeding and mulching shall be payment in full for carrying out all the required operations including full compensation for all materials, labour, tools and incidentals.

Preparation and Surface Treatment of Formation

Preparation and surface treatment of the formation, that is top of the subgrade, shall be carried out only after completion of any specified subgrade drainage and unless otherwise agreed by the Engineer, immediately prior to laying the sub-base or the road base where no sub-base is required. The sequence of operations shall be as follows:

All surfaces below carriageway, lay byes, footways and hard shoulders shall, after reinstatement of any soft areas to the required Specifications be well cleaned and freed of mud and slurry.

The surface shall be compacted by 4 passes of a smooth wheeled roller of 80 to 100 kN weight after spraying requisite amount of water, if required, before the commencement of rolling.

The formation shall, wherever necessary, be regulated and trimmed to the requirements of **Clause 5.20.4.9** with motor grader.

The trimmed formation shall be rolled by one pass of smooth wheeled roller of 80 to 100 kN weight after spraying requisite amount of water, if required, before the commencement of rolling.

Where the completed formation is not immediately covered with sub base or road base material, its moisture content shall be maintained to prevent cracking in the formation by suitable measures as approved by the Engineer. The entire work of surface treatment of formation shall be deemed as incidental to the work of sub-base / base course to be provided on the subgrade and as such no extra payment shall be made for the same.

Works to be Kept Free of Water

The Contractor shall arrange for the rapid dispersal of water collected / accumulated on the earthwork or completed formation during construction or on the existing roadway or which enters the earthwork or any other item of work from any source, and where practicable, the water shall be discharged into the permanent outfall of the drainage system. The arrangement shall be made in respect of all earthwork including excavation

for pipe trenches, foundations or cuttings.

The Contractor shall provide, where necessary, temporary water courses, ditches, drains, pumping or other means for maintaining the earthwork free from water. Such provisions shall include carrying out the work of forming the cut sections and embankments in such manner that their surfaces have at all times a sufficient minimum crossfall and, where practicable, a sufficient longitudinal gradient to enable them to shed water and prevent ponding.

The works involved in keeping the earthwork or any other item of works free of water shall be deemed as incidental to the respective item of work and as such no separate payment shall be made for the same.

3.23 Site Filling

3.23.1 Sand fill

Sandy fill shall be deposited to bring the grade level to the desired elevation after compaction of fill. Sandy fill shall be carried out in one of the following methods as detailed in the drawings:

Compaction of sandy fill by flooding the area shall be carried out where so specified. In this case, Contractor should ensure that the fill material is not washed away. This work shall be carried out as directed by Engineer.

Sandy fill shall be compacted where so specified by 12 tonne vibrating rollers. The fill material shall be compacted to the required density.

If the density of fill or use of rollers for compaction is not specified, Contractor shall ensure necessary compaction by the passage of trucks, carrying the fill material over the deposited fill in such a way that the entire fill area is covered. This will reasonably compact the sand fill and will be accepted by Engineer. However, Contractor shall ensure that every layer is thus compacted before the succeeding layers are deposited. Each layer shall not exceed 200mm in thickness.

3.23.2 Soil fill

Approved soil fill consisting of ordinary soil, murrum, soil containing gravel, shingle, etc. shall be deposited in layers not exceeding 200mm. Contractor should ensure that all clods of earth are broken down to a size not larger than 100mm.

Where density of fill or use of rollers is not specified, the fill shall be carried out as specified above.

Where specified, the required density to fill shall be obtained by proper compaction.

3.23.3 Measurement

Measurement shall be made on the basis of Clause 3.13.

4. CONCRETE AND ALLIED WORKS

1.1 Applicable Codes

4.1.1 Materials

1) IS: 269 Specification for 33 grade ordinary Portland cement.
2) IS: 455 Specification for Portland slag cement.
3) IS: 1489 Specification for Portland-pozzolana cement (Part 1&2).
4) IS: 8112 Specification for 43 grade ordinary Portland cement.
5) IS: 12269 Specification for 53 grade ordinary Portland cement.
6) IS: 12330 Specification for sulphate resisting Portland cement.
7) IS: 383 Specification for coarse and fine aggregates from natural sources for concrete.
8) IS: 432 Specification for mild steel and medium (tensile steel bars and hard-drawn steel) wires for concrete reinforcement. (Part 1 and 2)
9) IS: 1786 Specification for high strength deformed steel bars and wires for concrete reinforcement.
10) IS: 1566 Specification for hard-drawn steel wire fabric for concrete reinforcement.
11) IS: 9103 Specification for admixtures for concrete.
12) IS: 2645 Specification for integral cement water- proofing compounds for cement motar& concrete
13) IS: 4990 Specification for plywood for concrete shuttering work.

4.1.2 Material Testing

1) IS.4031 Methods of physical tests for hydraulic cement (Parts 1 to 15)
2) IS: 4032 Method chemical analysis of hydraulic cement.
3) IS: 650 Specification for standard sand for testing of cement.
4) IS: 2430 Methods for sampling of aggregates for concrete.
5) IS: 2386 Methods of test for aggregates for concrete (Parts 1 to 8)
6) IS: 3025 Methods of sampling and test (physical and chemical) for water used in industry.
7) IS: 6925 Methods of test for determination of water soluble chlorides in concrete admixtures.

4.1.3 Material Storage

1) IS: 4082 Recommendations on stacking and storing of construction materials and components at site

4.1.4 Concrete Mix Design

1) IS: 10262 Recommended guidelines for concrete mix design.
2) SP: 23 (S&T) Handbook on Concrete Mixes.

4.1.5 Concrete Testing

1) IS.1199 Method of sampling and analysis of concrete.
2) IS: 516 Method of test for strength of concrete.
3) IS: 9013 Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.
4) IS: 8142 Method of test for determining setting time of concrete by penetration resistance.
5) IS: 9284 Method of test for abrasion resistance of concrete.
6) IS: 2770 Methods of testing bond in reinforced concrete. Part I- Pullout test
7) IS: 2911 Code of Practice for design and construction of Pile foundations (Part 4)

4.1.6 Equipments

1) IS: 1791 General Requirements for batch type concrete mixers.
2) IS: 2438 Specification for roller pan mixer.
3) IS: 4925 Specification for concrete batching and mixing plant.
4) IS: 5892 Specification for concrete transit mixer and agitator.
5) IS: 7242 Specification for concrete spreaders.
6) IS: 2505 General Requirements for concrete vibrators: Immersion type.
7) IS: 2506 General Requirements for screed board concrete vibrators.
8) IS: 2514 Specification for concrete vibrating tables.
9) IS: 3366 Specification for pan vibrators.
10) IS: 4656 Specification for form vibrators for concrete.
11) IS: 11993 Code of practice for use of screed board concrete vibrators.
12) IS: 7251 Specification for concrete finishers.
13) IS: 2722 Specification for portable swing weigh batchers for concrete (single and double bucket type).
14) IS: 2750 Specification for steel scaffoldings.

4.1.7 Codes of Practice

1) IS: 456 Code of practice for plain and reinforced concrete.
2) IS: 457 Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
3) IS: 3370 Code of practice for concrete structures for storage of liquids (Parts 1 to 4)
4) IS: 3935 Code of practice for composite construction.
5) IS: 2204 Code of practice for construction of reinforced concrete shell roof.

6) IS: 2210 Criteria for the design of reinforced concrete shell structures and folded plates.
7) IS: 2502 Code of practice for bending and fixing of bars for concrete reinforcement.
8) IS: 5525 Recommendation for detailing of reinforcement in reinforced concrete works.
9) IS: 2751 Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.
10) IS: 9417 Specification for welding cold worked bars for reinforced concrete construction.
11) IS: 3558 Code of practice for use of immersion vibrators for consolidating concrete.
12) IS: 3414 Code of practice for design and installation of joints in buildings.
13) IS: 4326 Code of practice for earthquake resistant design and construction of building.
14) IS: 4014 Code of practice for steel tubular scaffolding (Parts 1 & 2)
15) IS: 2571 Code of practice for laying insitu cement concrete flooring.
16) IS: 7861 Code of practice for extreme weather concreting: Part 1 Recommended practice for hot weather concreting.
17) IS: 2911 Code of Practice for design and construction of Pile foundations
18) SP: 16 – 1980 Design Aids for Reinforced Concrete To IS 456: 1978
19) SP: 34 – 1987 Handbook on Concrete Reinforcement and Detailing

4.1.8 Construction Safety

1) IS: 3696 Safety code for scaffolds and ladders. (Parts 1 & 2)
2) IS: 7969 Safety code for handling and storage of building materials.
3) IS: 8989 Safety code for erection of concrete framed structures.

4.1.9 Measurement

1) IS 1200 Method of measurement of building and Engineering works
2) IS 3385 Code of practice for measurement of Civil Engineering works

4.2 General

The Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment and the quality control system. Such an inspection shall be arranged and the Engineer’s approval

obtained, prior to starting of concrete work. This shall, however, not relieve the Contractor of any of his responsibilities. All materials which do not conform to the Specifications shall be rejected.

Materials should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected. Materials complying with codes/standards shall generally be used. Other materials may be used after approval of the Engineer and after establishing their performance suitability based on previous data, experience or tests.

4.3 Materials

4.3.1 Cement

Unless otherwise called for by the Engineer, cement shall be ordinary Portland cement conforming to IS: 269, IS: 8112 or IS: 12269.

Where Portland pozzolana or slag cements are used, it shall be ensured that consistency of quality is maintained, there will be no adverse interactions between the materials and the finish specified is not marred.

Only one type of cement shall be used in any one mix. The source of supply, type or brand of cement within the same structure or portion thereof shall not be changed without approval from the Engineer.

Cement which is not used within 90 days from its date of manufacture shall be tested at a laboratory approved by the Engineer and until the results of such tests are found satisfactory, it shall not be used in any work.

4.3.2 Aggregates (General)

Aggregates shall consist of naturally occurring stones (crushed or uncrushed), gravel and sand. They shall be chemically inert, strong, hard, clean, durable against weathering, of limited porosity, free from dust/silt/ organic impurities/deleterious materials and conform to IS: 383. Aggregates such as slag, crushed over burnt bricks, bloated clay ash, sintered fly ash and tiles shall not be used.

Aggregates shall be washed and screened before use where necessary or if directed by the Engineer.
Aggregates containing reactive materials shall be used only after tests conclusively prove that there will be no adverse effect on strength, durability and finish, including long term effects, on the concrete.

The fineness modulus of sand shall neither be less than 2.2 nor more than 3.2.

The maximum size of coarse aggregate shall be as stated on the drawings but in no case greater than 1/4 of the minimum thickness of the member.

Plums 160 mm and above of a reasonable size may be used in mass concrete fill where directed. Plums shall not constitute more than 20% by volume of the concrete.

4.3.3 Water

Water used for both mixing and curing shall conform to IS: 456. Potable waters are generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.

4.3.4 Reinforcement

In general, reinforcement for buildings and sewage treatment units shall be HYSD-CRS (Corrosion Resistant Steel) of Grade Fe 500. All physical and chemical properties of this Fe 500 grade steel shall conform to IS: 1786-2008. Welded wire fabric shall conform to IS: 1566 as shown or specified on the drawing.

The CRS (corrosion resistant steel) index shall be at least 1.35 when tested for Salt Spray test as per “ASTM B 117 – 2009 test procedure for 120 hours when compared with the Fe 500 normal reinforcement bars and with same bar diameter. Test results have to be produced for the respective bar diameter for each consignment of steel delivered at site and at a frequency of every 20 Metric Tons.

Reinforcement bars produced using iron ore as the basic raw material only will be accepted. The manufacturer of Reinforcement bars must fall into the category of primary steel producer as defined by Ministry of Steel, Government of India.

All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirty, dust, or any other substance that will destroy or reduce bond.

4.3.5 Admixtures

Accelerating, retarding, water-reducing and air entraining admixtures shall conform to IS: 9103 and integral water proofing admixtures to IS: 2645.

Admixtures may be used in concrete as per manufacturer's instructions only with the approval of the Engineer. An admixture's suitability and effectiveness shall be verified by trial mixes with the other materials used in the works. If two or more admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be no increase in risk of corrosion of the reinforcement or other embedment.

Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted such as in mass concrete works, it shall be dissolved in water and added to the mixing water by an amount not exceeding 1.5 percent of the weight of the cement in each batch of concrete. The designed concrete mix shall be corrected accordingly.

4.4 Wastage

Wastage allowance for cement and steel and higher rolling margin for steel shall be considered in the item rate and no extra payment shall become payable to the Contractor on any account.

4.4.1 *Samples and Tests*

All materials used for the works shall be tested before use. Manufacturer's test certificate shall be furnished for each batch of cement/steel and when directed by the Engineer samples shall also be got tested by the Contractor in a laboratory approved by the Engineer at no extra cost to Employer. Sampling and testing shall be as per IS: 2386 under the supervision of the Engineer. Water to be used shall be tested to comply with requirements of IS: 456.

The Contractor shall furnish manufacturer's test certificates and technical literature for the admixture proposed to be used. If directed, the admixture shall be got tested at an approved laboratory at no extra cost.

4.5 Storing of Materials

All materials shall be stored in a manner so as to prevent its deterioration and contamination which would preclude its use in the works. Requirements of IS: 4082 shall be complied with.

The Contractor will have to make his own arrangements for the storage of adequate quantity of cement. If such cement is not stored properly and has deteriorated, the material shall be rejected. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be
stacked in any tier. Storage arrangement shall be approved by the Engineer. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order of receipt.

Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.

The Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.

The reinforcement shall be stacked on top of timber sleepers to avoid contact with ground/water. Each type and size shall be stacked separately.

4.6 Concrete

4.6.1 General

Concrete grade shall be as designated on drawings. In concrete grade M15, M20 etc. the number represents the specified characteristic compressive strength of 150 mm cube at 28 days, expressed in N/sq.mm as per IS:456. Concrete in the works shall be "DESIGN MIX CONCRETE" or "NOMINAL MIX CONCRETE". All concrete works of grade M5, M7.5, M10 and M15 shall be NOMINAL MIX CONCRETE whereas all other grades, M20 and above, shall be DESIGN MIX CONCRETE.

The grades of concrete to be used are noted on the drawings. In addition, the following table shall apply unless specified otherwise.

Structure	**Grade of Concrete**	**Max. Aggregate Size**
1. All Waste water retaining structures / box culverts, etc.	M30	20 mm
2. Sewage Pumping Station (Where concrete is in contact with Sewage) (a) for foundation raft (b) for walls, columns, floor beams, circular floor slab (c) for beams, slabs etc.	 M30 M30 M30	 40 mm 20 mm 20 mm
3. Valve chambers and pipe trenches (a) for foundation raft (b) walls, columns (c) for slabs, beams, etc.	 M25 M25 M25	 40 mm 20 mm 20 mm
4. Anchor blocks on pipeline, base slab of storm water drain	M15	40 mm
5. Saddles	M20	20 mm
6. Pipeline embankment, grade slab, ramps, footings under walls, SW drain coping etc	M15	20 mm
7. Bridges **Foundation of piers and abutments** **Piers and abutments with wing walls** **Hammer head of pipes**	 M25 M25 M25	 40 mm 40 mm 40 mm

9. Causeway	M20	20 mm
10. Other General Buildings (a) for foundation raft (b) walls, columns (c) for slabs, beams, etc.	 M25 M25 M25	 40 mm 20 mm 20 mm

4.6.2 Design Mix Concrete

4.6.2.0Mix Design & Testing

For Design Mix Concrete, the mix shall be designed according to IS: 10262 and SP:23 to provide the grade of concrete having the required workability and characteristic strength not less than appropriate values given in IS:456. The design mix shall in addition be such that it is cohesive and does not segregate and should result in a dense and durable concrete and also capable of giving the finish as specified. For liquid retaining structures, the mix shall also result in water tight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

The minimum cement content for Design Mix Concrete shall be as per Table-5 of IS: 456 or as given below, whichever is higher.

Grade of Concrete	Minimum Cement Content in Kg/Cu.m of Concrete
M15	260
M20	315
M25	360
M30	375

The minimum cement content stipulated above shall be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The Contractor's quoted rates for concrete shall provide for the above eventuality and nothing extra shall become payable to the Contractor in this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the Contractor.

The Contractor shall submit details of the source of all material and the proposed quantities of each ingredient per cubic metre of fully compacted concrete. The Contractor shall then make trial mixes for each class of concrete using the same Contractor's Equipment and the same materials as are proposed for the Permanent Works. The Contractor shall give 24 hours notice of such trials to enable the Engineer's Representative to attend. For each trial mix, three separate batches of concrete shall be made by the

Contractor and will be tested at 28 days all in accordance with IS: 516. Such trial mixes shall not be the first batch through the plant in any one sequence of concrete production.

The Contractor shall not commence concreting in the Permanent Works until details of trial mixes and test results for each class of concrete have been submitted to and approved by the Engineer.

Unless otherwise specified, only medium graded fine aggregate shall be used
A trial mix design will be approved by the Engineer with respect to strength if the average compressive strength of the nine cubes so tested is more than the target mean strength appropriate to the grade of concrete.
For concrete of Grade 30 and over the Contractor shall cast two sample wall panels 48 hours apart. Each shall be cast in two equal lifts to form a wall panel having one horizontal construction joint formed in the manner proposed by the Contractor for the Works. The top surface of the second lift shall have a Type U3 finish. The panels shall not be touched up after stripping. The panels shall be 300 mm thick and 1.5 m long by 1.5 m high. The Contractor shall not commence concreting in the Permanent Works until the test panels have been approved by Engineer.

The Contractor shall not alter the approved mix proportions nor the approved source of supply of any of the ingredients without having previously obtained the approval of the Engineer.

During production, the Engineer may require trial mixes to be made before a substantial change is made in the materials or in the proportions of the materials to be used.

It shall be the Contractor's sole responsibility to carry out the mix designs at his own cost. He shall furnish to the Engineer at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS:516 shall comply with the requirements of IS:456 as follows :

Grade of Concrete	**Minimum Compressive Strength N/sq.mm at 7 days**	**Specified Characteristic Compressive Strength N/sq.mm at 28 days**
M 15	10.0	15.0
M 20	13.5	20.0
M 25	17.0	25.0
M 30	20.0	30.0
M 35	23.5	35.0
M 40	27.0	40.0

A range of slumps which shall generally be used for various types of construction unless otherwise instructed by the Engineer is given below:

Structure/Member	**Slump in millimeters**	
	Maximum	**Minimum**
Reinforced foundation walls and footings	75	40
Plain footings, caissons and substructure walls	75	40
Slabs, Beams and reinforced walls	100	40
Pump & miscellaneous Equipment	75	40
Foundation	100	40
Building columns	50	40
Pavements	50	40
Heavy mass construction		

Note: All concreting done for water retaining structures shall have a minimum slump value of 60 mm and maximum of 100 mm

4.6.2.1 Batching & Mixing of Concrete

It is expected that batching plants of minimum 20 m^3 capacity and pumps for placing concrete shall be used. Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value.

Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account for moisture content in the aggregates. Water- cement ratio specified for use by the Engineer shall be maintained. Each time the work stops, the mixer shall be cleaned out, and while recommencing, the first batch shall have 10% additional cement to allow for sticking in the drum.

Arrangement should be made by the Contractor to have the cubes tested in an approved laboratory or in field with prior consent of the Engineer. Sampling and testing of strength and workability of concrete shall be as per IS:1199, IS:516 and IS:456.

4.6.3 Nominal Mix Concrete

Mix Design & Testing

Mix design and preliminary tests are not necessary for Nominal Mix Concrete. However works tests shall be carried out as per IS:456.

Proportions for Nominal Mix Concrete and W/C ratio may be adopted as per Table 9 of IS:456. However it will be the Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

Batching & Mixing of Concrete

Based on the adopted nominal mixes, aggregates shall be measured by volume. However cement shall be by weight only, using whole bags of cement.

4.7 Formwork

Formwork shall be all inclusive and shall consist of but not be limited to shores, bracings, sides of footings, walls, beams and columns, bottom of slabs etc. including ties, anchors, hangers, inserts, falsework, wedges etc.
The design and engineering of the formwork as well as its construction shall be the responsibility of the Contractor. However, if so desired by the Engineer, the drawings and calculations for the design of the formwork shall be submitted to the Engineer for approval.
Formwork shall be designed to fulfill the following requirements:

Sufficiently rigid and tight to prevent loss of grout or mortar from the concrete at all stages and appropriate to the methods of placing and compacting. Made of suitable materials. Capable of providing concrete of the correct shape and surface finish within the specified tolerance limits. Capable of withstanding without deflection the worst combination of selfweight, reinforcement and concrete weight, all loads and dynamic effects arising from construction and compacting activities, wind and weather forces.
Capable of easily striking without shock, disturbance or damage to the concrete.
Soffit forms capable of imparting a camber if required.
Soffit forms and supports capable of being left in position if required.
Capable of being cleaned and/or coated if necessary immediately prior to casting the concrete; design temporary openings where necessary for these purposes and to facilitate the preparation of construction joints.

The formwork may be of timber, plywood, steel, plastic or concrete depending upon the type of finish specified. Sliding forms and slip form may be used with the approval of the Engineer. Timber for formwork shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps and other surface defects. Joints between formwork and structures shall be sufficiently tight to prevent loss of slurry from concrete, using seals if necessary.
The faces of formwork coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before placing reinforcement. All rubbish, particularly chippings, shavings, sawdust, wire pieces dust etc. shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air at no extra cost.

Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be used. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of the Engineer. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.

Permanent formwork shall be checked for its durability and compatibility with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.

Wire ties passing through beams, columns and walls shall not be allowed. In their place bolts passing through sleeves shall be used. Formwork spacers left insitu shall not impair the desired appearance or durability of the structure by causing spalling, rust staining or allowing the passage of moisture.

For liquid retaining structures, sleeves shall not be provided for through bolts nor shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25 mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the formwork.

All corners and angles exposed in the finished structure shall have chamfers or fillets of 20 mm x 20 mm size, except where specified in the drawings.

Forms for substructure may be omitted when, in the opinion of the Engineer, the open excavation is firm enough (in hard non-porous soils) to act as a form. Such excavations shall be larger, as approved by the Engineer, than that required as per drawing to compensate for irregularities in excavation.

The Contractor shall provide adequate props carried down to a firm bearing without overloading any of the structures.

The shuttering for beams and slabs shall be so erected that the side shuttering of beams can be removed without disturbing the bottom shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be built up in sections as placing of concrete proceeds or windows left for placing concrete from the side to limit the drop of concrete to 1.0m or as approved by the Engineer. The Contractor shall temporarily and securely fix items to be cast (embedments/ inserts) in a manner that will not hinder the striking of forms or permit loss of grout.

Formwork showing excessive distortion, during any stage of construction, shall be repositioned and strengthened. Placed concrete affected by faulty formwork, shall be entirely removed and formwork corrected prior to placement of new concrete at Contractor’s cost.
The striking time for formwork shall be determined based on the following requirements:

1. Development of adequate concrete strength;
2. Permissible deflection at time of striking form work;
3. Curing procedure employed - its efficiency and effectiveness;
4. Subsequent surface treatment to be done;
5. Prevention of thermal cracking at re-entrant angles;
6. Ambient temperatures; and
7. Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).

Under normal circumstances (generally where temperatures are above 20^{o}C) forms may be struck after expiry of the time period given in IS:456 unless approved otherwise by the Engineer. For Portland Pozzolana/slag cement the stripping time shall be suitably modified as approved by the Engineer. It is the Contractor's responsibility to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not undergo excessive deformation and resist surface damage and any stresses arising during the construction period.

4.8 Reinforcement Workmanship

Reinforcing bars supplied bent or in coils shall be straightened cold without damage. No bending shall be done when ambient temperature is below 5^{o}C. Local warming may be permitted if steel is kept below 100^{o} C.

All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings/ schedules or as directed by the Engineer.

Re-bending or straightening incorrectly bent bars shall not be done without the approval of the Engineer.

Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by the Engineer prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause spalling of the concrete cover.

Binding wire shall be 16 gauge soft annealed wires. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.

Substitution of reinforcement, laps/splices not shown on drawing shall be subject to Engineer's approval.

4.9 Tolerances

Tolerance is a specified permissible variation from lines, grade or dimensions given in drawings. No tolerance specified for horizontal or vertical building lines or footings shall be construed to permit encroachment beyond the legal boundaries. Tolerance for formed and concrete dimensions shall be as per IS:456 unless specified otherwise.

Tolerances for R.C. Buildings

Variation from the Plumb

(i) In the lines and surfaces of columns, piers, walls and in arises 5 mm per 2.5 m or 25 mm, whichever is less.

(ii) For exposed corner columns and other conspicuous lines

In any bay or 5 m maximum	-	5 mm
In 10 m or more	-	10 mm

Variation from the level or from the grades indicated on the drawings

(i) In slab soffits, ceilings, beam soffits, and in arises

In 2.5 m	-	5 mm
In any bay or 5 m maximum	-	10 mm
In 10 m or more	-	15 mm

(ii) For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines :

In any bay or 5 m maximum	-	5 mm
In 10 m or more	-	10 mm

Variation of the linear building lines from established position in plan and related position of columns, wall and partitions:

In any bay or 5 m maximum	-	10 mm
In 10 m or more	-	20 mm

Variation in the sizes and locations of sleeves, openings in walls and floors – 5 mm except in the case of and for anchor bolts.

Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls

Minus	-	5 mm
Plus	-	10 mm

Footings

(i) Variation in dimension in plan

Minus - 5 mm
Plus - 50 mm

(ii) Misplacement or eccentricity

2% of footing width in the direction of misplacement but not more than 50 mm

(iii) Reduction in thickness

Minus - 5% of specified thickness subject to a maximum of 50 mm

Variation in steps

(i) In a flight of stairs

Rise - 3 mm
Tread - 5 mm

(ii) In consecutive steps

Rise - 1.5 mm
Tread - 3.0 mm

4.5.4 Tolerances in other structures

All structures

(i) Variation of the construction linear outline from established position in plan

In 5 m - 10 mm
In 10 m or more - 15 mm

(ii) Variations of dimensions to individual structure features from established positions

In 20 m or more - 25 mm
In buried construction - 50 mm

(iii) Variation from plumb, from specified batter or from curved surfaces of all structures

In 2.5 m - 10 mm
In 5 m - 15 mm
In 10 m or more - 25 mm
In buried construction - Twice the above amounts

(iv) Variation from level or grade indicated on drawings in slab, beams, soffits, horizontal grooves and visible arises.

In 2.5 m - 5 mm
In 7.5 m or more - 10 mm
In buried construction - Twice the above amounts

(v) Variation in cross-sectional dimensions of columns, beams, buttresses, piers and similar members

Minus - 5 mm
Plus - 10 mm

(vi) Variation in the thickness of slabs, walls, arch sections and similar members

Minus - 5 mm
Plus - 10 mm

Footing for columns, piers, walls, buttresses and similar members

(i) Variation of dimension in plan

Minus - 10 mm

Plus - 50 mm

(ii) Misplacement or eccentricity

2% footing width in the direction of misplacement but not more than 50 mm

(ii) Reduction in thickness

5% of specified thickness subject to a maximum of 50 mm.

Tolerance in fixing anchor bolts shall be as follows:

(i) Anchor bolts without sleeves : 1.5 mm in plan

(ii) Anchor bolts with sleeves : 5.0 mm in elevation

- for bolts upto and including 28 mm dia : 5 mm in all directions
- for bolts 32 mm dia and above : 3 mm in all directions

(iii) Embedded parts : 5 mm in all directions

Tolerances in Formwork:

The formwork shall be designed and constructed to the shapes, lines and dimensions shown on the drawings within the tolerances given below:

(i) Deviation from specified dimensions of cross sesection of columns and beams	- 6 mm + 12 mm
(ii) Deviations from dimensions of footings (Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel or dowels)	
- Dimension in plan	- 12 mm + 50 mm
- Eccentricity	0.02 times the width of the footing in the direction of deviation but not more than 50 mm
- Thickness	± 0.05 times the specified thickness

4.10 Preparation Prior to Concrete Placement

Before concrete is actually placed in position, the inside of the formwork shall be cleaned and mould oil applied, inserts and reinforcement shall be correctly positioned and securely held, necessary openings, pockets, etc. provided.

All arrangements-formwork, equipment and proposed procedure, shall be approved by the Engineer. Contractor shall maintain separate Pour Card for each pour as per the format enclosed.

Concrete shall be transported from the mixing plant to the formwork with minimum time lapse by methods that shall maintain the required workability and will prevent segregation, loss of any ingredients or ingress of foreign matter or water.

In all cases concrete shall be deposited as nearly as practicable directly in its final position. To avoid segregation, concrete shall not be re handled or caused to flow. For locations where direct placement is not possible and in narrow forms the Contractor shall provide suitable drops and "Elephant Trunks". Concrete shall not be dropped from a height of more than 1.0m as stipulated in clause 4.8.

Concrete shall not be placed in flowing water. Under water, concrete shall be placed in position by tremies or by pipeline from the mixer and shall never be allowed to fall freely through the water.
While placing concrete the Contractor shall proceed as specified below and also ensure the following:

4.10.1 Continuously between construction joints and pre- determined abutments.

4.10.2 Without disturbance to forms or reinforcement.

4.10.3 Without disturbance to pipes, ducts, fixings and the like to be cast in; ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.

4.10.4 Without dropping in a manner that could cause segregation or shock.

4.10.5 In deep pours only when the concrete and formwork designed for this purpose and by using suitable chutes or pipes.

4.10.6 Do not place if the workability is such that full compaction cannot be achieved.

4.10.7 Without disturbing the unsupported sides of excavations; prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the linings progressively as concrete is placed.

4.10.8 If placed directly onto hardcore or any other porous material, dampen the surface to reduce loss of water from the concrete.

4.10.9 Ensure that there is no damage or displacement to sheet membranes.

4.10.10 Record the time and location of placing structural concrete.

Concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer. Concrete shall be compacted during placing with approved vibrating equipment without causing segregation until it forms a solid mass free from voids thoroughly worked around reinforcement and embedded fixtures and into all corners of the formwork. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn slowly till air bubbles cease to come to the surface, leaving no voids. When placing concrete in layers advancing horizontally, care shall be taken to ensure adequate vibration, blending and melding of the concrete between successive layers. Vibrators shall not be allowed to come in contact with reinforcement, formwork and finished surfaces after start of initial set.

Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by the Engineer. The slump shall be held to the minimum necessary for conveying concrete by this method. When concrete is to be pumped, the concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

Except when placing with slip forms, each placement of concrete in multiple lift work shall be allowed to set for at least 24 hours after the final set of concrete before the start of subsequent placement. Placing shall stop when concrete reaches the top of the opening in walls or bottom surface of slab, in slab and beam construction, and it shall be resumed before concrete takes initial set but not until it has had time to settle as approved by the Engineer. Concrete shall be protected against damage until final acceptance.

4.11 Mass Concrete Works

Sequence of pouring for mass concrete works shall be as approved by the Engineer. The Contractor shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete if directed.

4.12 Curing

Curing and protection shall start immediately after the compaction of the concrete to protect it from:

Premature drying out, particularly by solar radiation and wind;
leaching out by rain and flowing water;
rapid cooling during the first few days after placing;
high internal thermal gradients;
low temperature or frost;
vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.

All concrete, unless approved otherwise by the Engineer, shall be cured by use of continuous sprays or ponded water or continuously saturated coverings of sacking, canvas, hessian or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.

Where a curing membrane is approved to be used by the Engineer, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. The curing compound to be used shall be approved by the Engineer before use and shall be applied with spraying equipment capable of a smooth, even textured coat.

Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened.

4.13 Construction Joints and Keys

Construction joints will be as shown on the drawing or as approved by the Engineer. Concrete shall be placed without interruption until completion of work between construction joints. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made with the approval of the Engineer.

Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as approved by the Engineer.
As soon as the exposed concrete has sufficiently hardened, the surface of the joint shall be water jetted or brushed with a stiff brush to expose the larger aggregate without being disturbed. Roughening of the surface by chipping or hacking will not generally be approved. Before placing fresh concrete against a construction joint all loose material shall be removed and the surface sluiced with water until it is perfectly clean, thereafter all ponded water should be removed.

When concreting is to be resumed on a surface which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this, a layer of concrete not exceeding 150 mm thickness shall be placed and well

rammed against the old work. Thereafter work shall proceed in the normal way.

4.13 Foundation Bedding

All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft or spongy areas shall be cleaned out and back filled with either soil-cement mixture, lean concrete or clean sand compacted as approved by the Engineer. The surfaces of absorptive soils shall be moistened.

Concrete shall not be deposited on large sloping rock surfaces. The rock shall be cut to form rough steps or benches by picking, barring or wedging. The rock surface shall be kept wet for 2 to 4 hours before concreting.

4.14 Finishes

4.14.1 General

The formwork for concrete works shall be such as to give the finish as specified. The Contractor shall make good any unavoidable defects as approved consistent with the type of concrete and finish specified; defects due to bad workmanship (e.g. damaged or misaligned forms, defective or poorly compacted concrete) will not be accepted. The Contractor shall construct the formwork using the correct materials and to meet the requirements of the design and to produce finished concrete to required dimensions, plumbs, planes and finishes.

4.14.2 Surface Finish Type F1

The main requirement is that of dense, well compacted concrete. No treatment is required except repair of defective areas, filling all form tie holes and cleaning up of loose or adhering debris. For surfaces below grade which will receive waterproofing treatment the concrete shall be free of surface irregularities which would interfere with proper and effective application of waterproofing material specified for use.

4.14.2 Surface Finish Type F2

The appearance shall be that of a smooth dense, well- compacted concrete showing the slight marks of well fitted shuttering joints. The Contractor shall make good any blemishes.

4.14.3 Surface Finish Type F3

This finish shall give an appearance of smooth, dense, well-compacted concrete with no shutter marks, stain free and with no discolouration, blemishes, arises, airholes etc. Only lined or coated plywood with very tight joints shall be used to achieve this finish. The panel size shall be uniform and as large as practicable. Any minor blemishes that might occur shall be made good by the Contractor.

4.14.4 Unformed Surfaces

Finishes to unformed surfaces of concrete shall be classified as U1, U2, U3, ‘spaded’ or ‘bonded’ concrete. Where the class of finish is not specified the concrete shall be finished to Class U1.

Class U1 finish is the first stage for Class U2 and U3 finishes and for a bonded concrete surface. Class U1 finish shall be a levelled and screeded, uniform plain or ridged finish which (unless it is being converted to Class U2, U3, or bonded concrete) shall not be disturbed in any way after the initial set and during the period of curing, surplus concrete being struck off immediately after compaction.

Where a bonded concrete surface is specified, the laitance shall be removed from the Class U1 finished surface and the aggregate exposed while the concrete is still green.
A spaded finish shall be a surface free from voids and brought to a reasonably uniform appearance by the use of shovels as it is placed in the Works.

Class U2 finish shall be a wood float finish. Floating shall be done after the initial set of the concrete has taken place and the surface has hardened sufficiently. The concrete shall be worked no more than is necessary to produce a uniform surface free from screed marks.

Class U3 finish shall be a hard smooth steel-trowelled finish. Trowelling shall not commence until the moisture film has disappeared and the concrete has hardened sufficiently to prevent excess laitance from being worked into the surface. The surfaces shall be trowelled under firm pressure and left free from trowel marks.

The addition of dry cement, mortar or water shall not be permitted during any of the above operations.

4.14.5 Integral Cement Finish on Concrete Floor

In all cases where integral cement finish on a concrete floor has been specified, the top layer of concrete shall be screeded off to proper level and tamped with tamper so that the aggregate shall be forced below the surface. The surface shall be finished with a wooden float and a trowel with pressure. The finish shall be continued till the concrete reaches its initial set. No cement or cement mortar finish shall be provided on the surface. Where specified, a floor hardener as approved by the Engineer shall be supplied and used as recommended by the manufacturer.

4.16 Repair and Replacement of Unsatisfactory Concrete

Immediately after the shuttering is removed, all the defective areas such as honey-combed surfaces, rough patches, holes left by form bolts etc. shall be

inspected by the Engineer who may permit patching of the defective areas or reject the concrete work.

All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

Rejected concrete shall be removed and replaced by the Contractor at no additional cost to the Employer.

For patching of defective areas all loose materials shall be removed and the surface shall be prepared as approved by the Engineer.

Bonding between hardened and fresh concrete shall be done either by placing cement mortar with approved bonding agent or by applying epoxy. The decision of the Engineer as to the method of repairs to be adopted shall be final and binding on the Contractor. The surface shall be saturated with water for 24 hours before patching is done with 1:5 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as approved by the Engineer.

All the form bolt repairs and delayed repairs shall be carried out using a proportion of white cement in repair mix to the approval of the Engineer, so as to match the colour of the surrounding area.

4.17 Vacuum Dewatering of Slabs

Where specified floor slabs, either grade or suspended, shall be finished by vacuum dewatering including all operations such as poker vibration, surface vibration, vacuum processing, floating and trowelling as per equipment manufacturers recommendation. The equipment to be used shall be subject to the Engineer’s approval.

4.18 Hot Weather Requirements

Concreting during hot weather shall be carried out as per IS:7861 (Part I).

Adequate provisions shall be made to lower concrete temperatures which shall not exceed 33^{o}C at the time of placement of fresh concrete.

Where directed by the Engineer, the Contractor shall spray non-wax based curing compound on unformed concrete surfaces at no extra costs.

4.19 Liquid Retaining Structures

The Contractor shall take special care for concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.

The minimum level of surface finish for liquid retaining structures shall be Type F2. All such structures shall be hydro-tested.

The Contractor shall make all arrangements for hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipe lines etc.

Any temporary arrangements that may have to be made to ensure stability of the structures shall also be considered to have been taken into account while quoting the rates.

Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement/epoxy pressure grouting, guniting or such other methods as may be approved by the Engineer. All such rectification shall be done by the Contractor to the entire satisfaction of the Employer/Engineer at no extra cost to the Employer.

4.20 Testing Concrete Structures for Leakage

Hydro-static test for water tightness shall be done at full storage level or soffit of cover slab, as may be directed by the Engineer, as described below:
In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.

In the case of structures whose external faces are buried and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hours over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period for seven days shall be taken as an indication of the water tightness of the structure. The Engineer shall decide on the actual permissible nature of this drop in the surface level, taking into account whether the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

Each compartment/segment of the structure shall be tested individually.
For structures such as pipes, tunnels etc. the hydrostatic test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss

of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

4.21 Optional Tests

If the Engineer is not satisfied with the results of the tests under Clause 4.5 or otherwise considers that the materials i.e. cement, sand, coarse aggregates, reinforcement and water are not in accordance with the Specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the Engineer, as per relevant IS Codes. Contractor shall have to pay for these tests.

In the event of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths, the Engineer reserves the right to order the Contractor to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure, etc. The Engineer also reserves the right to ask the Contractor to dismantle and re-do such unacceptable work, at no cost to the Employer.

If the structure is certified as failed by Engineer, the cost of the test and subsequent dismantling/reconstruction shall be borne by the Contractor.
The quoted unit rates/prices of concrete shall be deemed to provide for all tests mentioned above.

4.22 Grouting

4.22.1 Standard Grout

Grout shall be provided as specified on the drawings. The proportion of Standard Grout shall be such as to produce a flow able mixture consistent with minimum water content and shrinkage. Surfaces to be grouted shall be thoroughly roughened and cleaned. All Structural steel elements to be grouted shall be cleaned of oil, grease, dirt etc. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete shall be saturated with water and just before grouting water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by Engineer. The grout proportions shall be limited as follows:

Use	Grout Thickness	Mix Proportions	W/C Ratio (max)
a) Fluid mix	Under 25mm	One part Portland Cement to one part sand	0.44
b) General mix	25mm and over but less than 50mm	One part Portland Cement to 2 parts of sand	0.53
c) Stiff mix	50mm and over	One part Portland	0.53

		Cement to 3 parts of sand	

Non-Shrink Grout

Non – shrink grout where required shall be provided in strict accordance with the manufacturer’s instructions / specifications on the drawings.

4.23 Inspection

All materials, workmanship and finished construction shall be subject to continuous inspection and approval of Engineer. Materials rejected by Engineer shall be expressly removed from site and shall be replaced by Contractor immediately.

4.24 Clean-Up

Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris, scraps of wood, etc. resulting from the work shall be removed and the premises left clean.

4.25 Acceptance Criteria

Any concrete work shall satisfy the requirements given below individually and collectively for it to be acceptable.

a) Properties of constituent materials;
b) Characteristic compressive strength;
c) specified mix proportions;
d) Minimum cement content;
e) Maximum free-water/cement ratio;
f) Workability;
g) Temperature of fresh concrete;
h) Density of fully compacted concrete;
i) cover to embedded steel;
j) Curing;
k) Tolerances in dimensions;
l) Tolerances in levels;
m) Durability;
n) Surface finishes;
o) Special requirements such as;
    i) Water tightness
    ii) Resistance to aggressive chemicals
    iii) Resistance to freezing and thawing
iv) Very high strength
    v) Improved fire resistance
    vi) Wear resistance
    vii) Resistance to early thermal cracking

The Engineer's decision as to the acceptability or otherwise of any concrete work shall be final and binding on the Contractor.

For work not accepted, the Engineer may review and decide whether remedial measures are feasible so as to render the work acceptable. The Engineer shall in that case direct the Contractor to undertake and execute the remedial measures. These shall be expeditiously and effectively implemented by the Contractor. Nothing extra shall become payable to the Contractor by the Employer for executing the remedial measures.

4.26 Mode of Measurement and Payment

The unit rate for concrete work under various categories shall be all inclusive and no claims for extra payment on account of such items as leaving holes, embedding inserts, etc. shall be entertained unless separately provided for in the Schedule of Quantities. No extra claim shall also be entertained due to change in the number, position and/or dimensions of holes, slots or openings, sleeves, inserts or on account of any increased lift, lead of scaffolding etc. All these factors should be taken into consideration while quoting the unit rates. Unless provided for in the Schedule of Quantities the rates shall also include fixing inserts in all concrete work, whenever required.

Payments for concrete will be made on the basis of unit rates quoted for the respective items in the Schedule of Quantities. No deduction in the concrete quantity will be made for reinforcements, inserts etc. and opening less than 0.100 of a sq.m. and 0.010 cu.m where concrete is measured in cu. metres. Where no such deduction for concrete is made, payment for shuttering work provided for such holes, pockets, etc. will not be made. Similarly the unit rates for concrete work shall be inclusive or exclusive of shuttering as provided for in the Schedule of Quantities.

Payment for beams will be made for the quantity based on the depth being reckoned from the underside of the slabs and length measured as the clear distance between supports. Payment for columns shall be made for the quantity based on height reckoned upto the underside of slabs/beams.

The unit rate for precast concrete members shall include formwork, mouldings, finishing, hoisting and setting in position including setting mortar, provision of lifting arrangement etc. complete. Reinforcement and inserts shall be measured and paid for separately under respective item rates.

Only the actual quantity of steel embedded in concrete including laps as shown on drawings or as approved by Engineer shall be measured and paid for, irrespective of the level or height at which the work is done. The unit rate for reinforcement shall include all wastages, binding wires, chairs, spacer bars etc. for which no separate payment shall be made.

Where the formwork is paid for separately, it shall be very clearly understood the payment for formwork is inclusive of formwork, shuttering, shoring, propping scaffolding etc. Only the net area of concrete formed (shuttered) shall be measured for payment.

4.26.1 Material

The material for the PVC waterstops shall be a plastic compound with the basic resin of polyvinyl chloride and additional resins, plasticizers, inhibitors, which satisfies the performance characteristics specified below as per IS:12200. Testing shall be in accordance with IS: 8543.

a) Tensile strength : 11.6 N/mm^2 minimum
b) Ultimate elongation : 300% minimum
c) Tear resistance : 4.9 N/mm^2 minimum
d) Stiffness in flexure : 2.46 N/mm^2 minimum
e) Accelerated extraction
   i) Tensile strength : 10.50 N/mm^2 minimum
   ii) Ultimate elongation : 250% minimum
(f) Effect of Alkali : 7 days
   i) Weight increase : 0.10% maximum
   ii) Weight decrease : 0.10% maximum
   iii) Hardness change : ± 5 points
(g) Effect of Alkali : 28 days
   i) Weight increase : 0.40% maximum
   ii) Weight decrease : 0.30% maximum
   iii) Dimension change : ±1%

PVC water stops shall be either of the bar type, serrated with center bulb and end grips for use within the concrete elements or of the surface (kicker) type for external use.

PVC water stops shall be of approved manufacture. Samples and the test certificate shall be got approved by the Engineer before procurement for incorporation in the works.

4.26.2 Workmanship

Waterstops shall be cleaned before placing them in position. Oil or grease shall be removed thoroughly using water and suitable detergents.

Waterstops shall be procured in long lengths as manufactured to avoid joints as far as possible. Standard L or T type of intersection pieces shall be procured for use depending on their requirement. Any non-standard junctions shall be made by cutting the pieces to profile for jointing. Lapping of waterstops shall not be permitted. All jointing shall be of fusion welded type as per manufacturer's instructions.

Water stops shall be placed at the correct location/level and suitably supported at intervals with the reinforcement to ensure that it does not deviate from its intended position during concreting and vibrating.

Particular care shall also be taken to ensure that no honey-combing occurs because of the serrations/end grips. Projecting portions of the waterstops embedded in concrete shall be thoroughly cleaned of all mortar/ concrete coating before resuming further concreting operations. The projecting waterstop shall also be suitably supported at intervals with the reinforcement to maintain its intended position during concreting so as to ensure that it does not bend leading to formation of pockets.

4.26.3 Measurement

Measurement shall be in running meters correct to two places of decimal. No separate payment shall be made for joints or intersection pieces.

4.27 Preformed Fillers and Joint Sealing Compound

4.27.1 Materials

Preformed filler for expansion/isolation joints shall be non-extruding and resilient type of bitumen impregnated fibers conforming to IS:1838 (Part I) or equivalent.

Bitumen coat to concrete/masonry surfaces for fixing the preformed bitumen filler strip shall conform to IS:702. Bitumen primer shall conform to IS: 3384.

Sealants shall be of the following types:

Sealant Type A

Sealant Type A shall be a gun grade, non-slumping compound suitable for sealing horizontal, vertical and soffit joints in water retaining structures. It shall be a UK WFBS material approved for unrestricted use in contact with potable water to the full exposure condition of 15,000 mm^2/l, and shall not support bacterial growth.

It shall be stable and shall have a low water absorption and good adhesion to concrete.

Hardness (Shore A) : > 12

Transverse Movement Accommodation : ±15%

Sealant Type B

Sealant type shall be a gun grade compound, suitable for sealing vertical movement and construction joints in concrete structures. It shall be flexible, resistant to aging, physical damage and weathering and shall have good adhesion to concrete.

Hardness (Shore A) : > 12

Transverse Movement Accommodation : ±12.5%

Sealant Type C

Sealant type C shall be similar to Type B above. In addition it shall have been designed for sealing movement and construction joints in hydraulic

and water retaining structures and shall be suitable for use in contact with potable water.
Hardness (Shore A) : > 20
Transverse Movement Accommodation : ±12.5%

Sealant Type D
Sealant Type D shall be a pourable compound suitable for sealing horizontal movement and construction joints in concrete structures. It shall be flexible, resistant to aging, physical damage and weathering and shall have good adhesion to concrete.
Hardness (Shore A) : > 9
Transverse Movement Accommodation : ±12.5%

Sealant Type E
Sealant Type E shall be a cold pouring compound complying with BS 5212, suitable for sealing movement and construction joints in concrete paved areas. It shall be resistant to fuels, oils and hydraulic fluids. It shall be tough, abrasion-resistant and shall not decompose in strong sunlight.
Hardness (Shore A) : > 12
Transverse Movement Accommodation : ±12.5%

Approved Sealants
The following approved sealants meet the above specifications.
Sealant Type A, B and C : Thioflex600 gun grade
Sealant Type D : Thioflex 600 pourable grade
Sealant Type E : Colpor 200

The hardness value specified in the above summaries is the Shore A Durometer value at 14 days at 25° C and 50% RH. The specified transverse movement values are based on joints having a width to depth ratio of 1.5: 1. The Contractor may use the above sealants or ones meeting equivalent or higher specifications.

4.27.2 Workmanship
The thickness of the preformed bitumen filler shall be 25mm for expansion joints and 50mm for isolation joints around foundation supporting rotatory equipment's. Contractor shall procure the strips of the desired thickness and width in lengths as manufactured. Assembly of small pieces/thicknesses of strips to make up the specified size shall not be permitted.

The concrete/masonry surface shall be cleaned free from dust and any loose particles. When the surface is dry, one coat of industrial blown type bitumen of grade 85/25 conforming to IS:702 shall be applied hot by brushing at the rate of 1.20 kg/sq.m. When the bitumen is still hot the preformed bitumen filler shall be pressed and held in position till it completely adheres. The surface of the filler against which further concreting/masonry work is to be

done shall similarly be applied with one coat of hot bitumen at the rate of 1.20 kg/sq.m.

Sealing compound shall be heated to a pouring consistency for enabling it to run molten in a uniform manner into the joint. Before pouring the sealing compound, the vertical faces of the concrete joint shall be applied hot with a coat of bitumen primer conforming to IS:3384 in order to improve the adhesive quality of the sealing compound.

Expansion joints between beams/slabs shall be provided with 100mm wide x 4mm thick mild steel plate at the soffit of RCC beams/slabs to support and prevent the preformed joint filler from dislodging. This plate shall be welded to an edge angle of ISA 50 x 50 x 6mm provided at the bottom corner, adjacent to the expansion joint of one of the beams/slabs, by intermittent fillet welding. Steel
surfaces shall be provided with 2 coats of red oxide zinc chrome primer and 3 coats of synthetic enamel paint finish.

The Contractor shall construct recesses at all joints and on both faces of the concrete work except on the underside of ground slabs. The recesses shall be accurately formed to the lines and dimensions shown on the Drawings or as agreed with the Engineer.

The Contractor shall prepare the surfaces of the recess and shall supply a joint sealer and fill or caulk the recess completely with it.

Joint sealing shall not be commenced without the approval of the Engineer. In reservoir joints the sealer shall be poured after completion of the water tightness test, to the satisfaction of the Engineer.

All joint sealers shall be from an approved manufacturer. The Contractor shall supply the manufacturer’s test certificates for each consignment of each type of joint sealant delivered to the Site and shall if requested supply to the Engineer sufficient samples of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate test procedure.

Sealants shall be installed in strict accordance with the manufacturer’s instructions. De-bonding strip shall be used in conjunction with the sealers as indicated on the Drawings. The de-bonding strip shall be compatible with the joint sealer and shall be resistant to attach from the primer used to bond the sealer to the concrete.

Polysulphide and polyurethane sealants shall not abut bitumen sealers. Surfaces to receive Polysulphide and polyurethane sealants shall be kept free from bituminous paints. All sealants shall be appropriate for the

prevailing climatic conditions. Bituminous sealants shall comply with the BS 2499 for Type A1. Polysulphide sealants shall comply with IS 12118.

4.27.3 Measurement

Measurement for the preformed joint filler shall be in sq.m correct to two places of decimal for the specified thickness as per items of work. Measurement for applying the bitumen coat to concrete/masonry surfaces shall be in sq.m correct to two places of decimal. Measurement for the joint sealing compound shall be in running metres correct to two places of decimal for the specified width and thickness as per the items of work. Measurement for the mild steel corner angle and plate shall be by weight as per the items of work.

4.28 Concreting Records

A written record of the concrete works shall be made each day by the Contractor and kept available for inspection by the Engineer. The diary shall contain notes and records of :

1. The names of the Contractor's Engineer who are responsible for the different phases of the concrete work and also the names of their assistants.
2. The temperatures of air, water, cement, aggregate, together with the air humidity and type of weather.
3. Deliveries to the Site of concrete materials (quantity, brand of concrete, etc).
4. Inspections carried out, tests performed, etc. and their results.
5. Times of commencement and completion of different parts of the concrete works and times of erection and striking of forms.
6. Quantity of cement, fine and coarse aggregate and admixture used for each section of work and the number and kind of test samples taken on these ingredients and water.

CONCRETE POUR CARD

CLIENT : DATE : POUR NO. :
PROJECT : STRUCTURE :
Contractor : MAX. AGGREGATE SIZE / SLUMP :
DRG. NO. : START / COMPLETION TIME : /
CONCRETE GRADE / QUANTITY : MIXING TIME :
/

SL. NO.	ITEM	Contractor's Rep. Sign	Engineer's Sign	Remarks

1.	BEFORE CONCRETING	CENTRELINES CHECKED				POUR AUTHORISED SITE ENGINEER
2.		FORMWORK AND STAGING CHECKED FOR ACCURACY, STRENGTH & FINISH				
3.		REINFORCEMENT CHECKED				
4.		COVER TO REINFORCEMENT CHECKED				
5.		VERIFIED TEST CERTIFICATE FOR CEMENT/STEEL		YES / NO	YES / NO	
6.		ADEQUACY OF MATERIALS / EQUIPMENT FOR POUR		YES / NO	YES / NO	
7.		EMBEDDED PARTS	CIVIL			
		CHECKED	MECHANICAL			
		(LOCATION & PLUMB)	ELECTRICAL			
8.	SOFFIT(S) & POUR TOP(T) LEVELS CHECKED BEFORE (B) & AFTER (A) FORM REMOVAL (ONLY OF BEAMS OF OVER 10 M SPAN & IMPORTANT STRUCTURE LIKE T.G. ETC.)		S(B) T(B) S(A) T(A)			
9.	CONSTRUCTION JOINTS LOCATION & TIME (IF NOT AS PER DRAWING)					
10.	CEMENT CONSUMPTION IN KGS.					
11.	NUMBER OF CUBES AND IDENTIFICATION MARKS					
12.	TEST CUBE RESULTS (7 DAYS / 28 DAYS)					
13.	CONCRETE CONDITION ON FORM REMOVAL		V.GOOD/GOOD/FAIR/ POOR			

SITE-IN-CHARGE

NOTES :

1. EACH ITEM TO BE CHECKED AND SIGNED BY THE RESPECTIVE ENGINEERS.
2. ITEMS 8 TO 13 (BOTH INCLUSIVE) TO BE FILLED ONLY BY ENGINEER.
3. EACH POUR TO HAVE SEPARATE CARDS, IN TRIPLICATE ONE EACH FOR CLIENT, CONSULTANT & SITE OFFICE.

UNDER REMARKS INDICATE DEVIATIONS FROM DWGS. & SPECIFICATIONS, CONGESTION IN REINFORCEMENT IF ANY, UNUSUAL OCCURENCES, SUCH AS FAILURE OF EQUIPMENTS, SINKING OF SUPPORTS / PROPS. HEAVY RAINS AFFECTING CONCRETING, POOR COMPACTION, IMPROPER CURING, OTHER DEFICIENCIES, OBSERVATIONS ETC.

5.Steel Pipe work

The term “pipe work” means pipe of any description and includes associated flanges, adopters, couplings, jointing materials, fittings, supports, valves, traps and the like which are necessary to complete station pipe work systems associated with Pumping Station.

The Contractor shall design, manufacture, supply, fabricate, and install the pipe work in accordance with the Specification and to satisfy pipe work function of Pump Station. The Contractor’s specification for the fabrication of pipe work shall be submitted for the Employer’s approval. The information provided shall be, when applicable, as listed below:

(a) Purpose
(b) Contents
(c) Related documents
(d) Definitions
(e) Application standards
(f) Drawings
(g) Materials
(h) Fabrication - general;
- tolerance;
- preparation;
- fit-up;
- threading;
- bends;
- welding;
- heat treatment:
- after fabrication treatment
- inspection

(i) Preparation and protection finishing of surfaces
(j) Marking and coding for identification and matching
(k) Acceptable welder’s qualification

All pipes, fittings, bolts, nuts, jointing materials, pipe supports, thrust blocks and appurtenances for piping to be required for execution of the Works shall be manufactured and erected in accordance with the erection plans, specifications to be provided by the Contractor and approved by the Employer. All pipe work and fittings shall be rated to the higher pressure class in excess of the maximum pressure attained in service including any surge pressure. Minimum 2 mm corrosion allowance shall be considered. Buried pipes in addition to above, shall be designed to withstand external loading exerted by soil, water, and live loads as relevant. The external ground water shall be taken at ground level for design purposes. Material of steel pipes and fittings shall conform to IS: 2062. Fabrication and testing shall be in accordance with IS: 3589 for pipes and BS EN 1092 for flanges.

All pipe line shall be marked the flow direction, and print ink the name of liquid to be carried as well as name of the destination of facility.

Underground pipe line must be shown the location by concrete pole that indicates its lay underground depth and its flow direction.

The pipe work installation shall be so arranged to offer ease of dismantling and removal of pumps or other major items of equipment. Stainless steel to Grade AISI 304 expansion bellows which can take radial and axial misalignment of minimum 1 percent of valve nominal size with tie rods shall be included in the suction and delivery pipe work of all pumps as well as on delivery header for easy dismantling, and provision shall be made for a flexible joint arrangement to building structures. All loose flanges shall be secured to fixed flanges by suitable tie-bolts.

All necessary supports, saddles, slings, fixing bolts and foundation bolts shall be supplied to support the pipe work and its associated equipment in an approved manner. Valves, meters, strainers and other devices mounted in the pipe work shall be supported independently of the pipes to which they connect. All brackets or other forms of support, which can conveniently be so designed, shall be rigidly built up of steel by welding and coated by paint after wielding works.

All pipe work shall be adequately supported with purpose-made fittings. When passing through walls, pipe work shall incorporate a puddle flange or other suitable sealing device.

Flange adapters and unions shall be supplied and fitted in pipe work runs, wherever necessary, to permit the simple disconnection of flanges, valves and equipment. The final outlet connection of the pipe work shall match the connecting point of the transmission main.

Flanged joints shall be made with minimum 6 mm thick full face, fabric reinforced rubber gaskets, pierced to take the bolts, and the face of all flanges shall be machined to give a true angle of 90 degree to the centre line of the pipe or fittings. All necessary supports, saddles, slings, fixing bolts and foundation bolts shall be supplied to support the pipe work and its associated equipment in an approved manner. Valves, meters and other devices mounted in the pipe work shall be supported independently of the pipes to which they are connected. Bolts for flange connection must be tightening adequate force in comply with international standards or approved by the Engineer.

The whole of the jointing work and materials necessary to fix and connect the pipes, including adequate and efficient pipe support shall be included in the Contract. The Contractor shall be responsible for ensuring that the internal surface of all pipe work is thoroughly clean before and during erection and before commissioning. Cleaning shall include removal of all dirt, rust, scale and welding slag due to Site welding. Before dispatch from the manufacturer’s works, the ends of the pipes, branch pipes, etc., shall be suitably capped and covered to prevent any accumulation of dirt or damage. This protection shall not be removed until immediately prior to connecting adjacent pipes, valves or pumps. All small bore pipes shall be blown through with compressed air before connection is made to instruments and other equipment. No point of passage of pipes through floors or walls shall be used as a point of support, except with the approval of the Engineer.

Pipe/fitting material and dimensional standard shall conform to following :

1. Size mm (NB	**2. Material Specification(Mil**	**3. Dimensional Standard** **4. (Mild**	**5. Material Specification**	**7. Dimensional Standard**
9. Pipes up to150 mm	**10.** 1239 PT, ERW, Black PT-1 HVY	**11.** 1239 ERW	**12.** ASTM A 312	**13.** ANSI B 36.19
14. 200 to 2400	**15.** 2 06 2	**16.** 3589 - ERW 3589 for dimensions and **17.** minimum thickness. Pipe thickness shall be as per2825	**18.** ASTM A	**20.** ANSI B 36.19
21. Elbows upto	**22.** ASTM-A105	**23.** ANSI B 16.11 3000 #S.W.	**24.** ASTM A 182	**25.** ANSI B 16.11
26. 40 to 150	**27.** ASTM-A 234 GRWPB	**28.** ANSI B 16.9	**29.** ASTM A 403	**30.** ANSI B 16.19
31. 200 & above(m	**32.** 2 06	**33.** LR. BE. Sch 40ANSI B 31.1	**34.** ASTM A 403	**35.** ANSI B 16.19
36. Coupling upto 25	**37.** ASTM-A 105	**38.** ANSI B 16.11 3000 #S.W.	**39.** ASTM A 182	**40.** ANSI B 16.113000 S.W.
41. Tees 40 to200	**42.** ASTM - A 234GR WPB	**43.** ANSI B 16.9 BE, Sch 40	**44.** ASTM A 403	**45.** ANSI B 16.9 BE,Sch 40
46. Above 200	**47.** IS 2062	**48.** IS 2825 (min. Pipe thickness)	**49.** ASTM A 403	**50.** ANSI B 16.9 BE, Sch 40
51. Reducers upto 25	**52.** ASTM-A 105	**53.** ANSI B 16.11 3000S.W.	**54.** ASTM A 182	**55.** ANSI B 16.113000 S.W.

56. Size mm (NB	**57. Material Specification(Mil**	**58. Dimensional Standa**	**60. Material Specificati**	**62. Dimensional Standa**
64. 40 to 200	**65.** ASTM-A 234 GRWPB	**66.** ANSI B 16.9 BE,Sch 40	**67.** ASTM A 403	**68.** ANSI B 16.9 BE,Sch 40
69. Above 200	**70.** 2062	**71.** IS 2825 (min. Thickness for larger pipes)	**72.** ASTM A 403	**73.** ANSI B 16.9 BE,Sch 40
74. Flan	**75.** 2062	**76.** BS EN	**77.** ASTM A	**78.** BS EN
79. Bolts, Anchor Bolts	**80.** SS316	**81.** 1364	**82.** SS316	**83.** 1364
84. Gaskets All	**85.** 638 (rubber) reinforc	**86.** 3 mm thickness	**87.** 638 (rubber) reinforc	**88.** 3 mm thickness

Facilities shall be provided for draining the pipe system and releasing air.

The pipe work layout within pump stations shall have the approval of the pump manufacturer. Fluid velocities in suction pipe work leading to pumps shall not exceed 1.5 m/s. Fluid velocities in delivery pipe work leading from pumps shall not exceed 2.0 m/s.

The whole of the jointing work and materials necessary to fix and connect the pipes, including adequate and efficient pipe support shall be included in the Contract. The Contractor shall be responsible for ensuring that the internal surface of all pipe work is thoroughly cleaned before and during erection and before commissioning.

Cleaning shall include removal of all dirt, rust, scale and welding slag due to Site welding. Before dispatch from the manufacturer's works, the ends of the pipes, branch pipes, etc., shall be suitably capped and covered to prevent any accumulation of dirt or damage. This protection shall not be removed until immediately prior to connecting adjacent pipes, valves or pumps. All small bore pipes shall be blown through with compressed air before connection is made to instruments and other equipment. No point of passage of pipes through floors or walls shall be used as a point of support, except with the approval of the Employer.

Hydrostatic shop test for pipes and fittings shall be as per code/standard requirement. After erection at site, complete pipes and fittings shall be hydrostatically tested for a pressure of 1.5 times operating pressure.

Flanges, if fabricated in segments shall be fully radiographed and stress relieved. If fabricated out of billets/bars by cold rolling, welded flanges shall be radiographed and normalized.

Puddle flanges shall be fitted to pipes where the structure through which they pass is required to take thrust resulting from the pipe. Puddle flanges shall also be fitted where a water barrier is required. All puddle flanges shall be clearly shown on the drawings and the resultant thrust clearly indicated. Puddle flanges shall only be fitted with the prior approval of the Employer.

Buried pipes shall in addition be designed to withstand external loading exerted by soil, water, and live loads as relevant. The external ground water shall be taken at ground level for design purposes.

Saddle type/bracket typesupport wherever required shall be designed and supplied for the above ground pipe lines.

Protectionforpipeslaidundergroundshallbebycoatingandwrappingsystemgivingafinalcoatthicknessof4.5mmmaybeemployed.Suchprotectionshallcomprise1.5mmofcoaltarprimerapplication on a thoroughly cleaned surface, to be followed with fiber glass wraps set in coal tar enamelcoats conforming to American Water Works Association specification C/203/57 fora total

thickness of3mm. Such lining shall meet a spark test to be approved with a holiday detector of 10000 Volts.

TheContractorshallindicateonhisdetaileddrawingswhatthrustblocksa rerequiredtoanchorpipeworksuppliedbyhim.Particularcareshallbetakentoens urethatpipeworkthrustsare,asfaraspossible, not transmitted to machinery or other associated apparatus.

Puddleflangesshallbefittedtopipeswherethestructurethroughwhichth eypassisrequiredtotakethrustresultingfromthepipe.Puddleflangesshallalsobe fittedwhereawaterbarrierisrequired.Allpuddle flanges shall be clearly shown on the drawings and the resultant thrust clearly indicated. Puddleflanges shall only be fitted with the prior approval of the Employer.

Buried pipes shall in addition be designed to withstand external loading exerted by soil, water, and liveloadsas relevant.Theexternalgroundwater shallbetaken atgroundlevelfordesignpurposes.Saddletype/brackettypesupportwhereverre quiredshallbedesignedandsuppliedfortheabovegroundpipelines.

Allpipejointsshallbeofthebuttweldedtype.Endpreparationsandfabrica tionrequirementsshallgenerally conform to I.S. 2825. Flanges, if fabricated in segments, shall be fully radiographed and stressrelieved

Laying of welded steel pipes shall meet the requirements of IS 5822.

Some of manufactures of MS pipe are detailed below:

	M.S. PIPES
1.	M/s. Steel Authority of India Ltd., No.8, BISL Building, J.C. Road, Bangalore-560 002.
2.	M/s. Welspun, Trade World, 'B' Wing, 9th Floor, Kamala Mills Compound, Senapati Bepat Marg, Lower Parel, Mumbai- 400 013,
3.	M/s. Swastik Pipes Ltd., No.41, K.M. Delhi, Rohtak Road, District Jhajjar (Haryana).
4.	M/s. Asian Mills Pvt.Ltd., 104, Sarkar-III Opp. Old High Court, Near Income Tax Circle, Ahmedabad-380 014.
5.	M/s. Surya Engineers, Plot No. G20/8, MIDC Area, Ahmadnagar, Maharashtra.
6.	M/s. PSL Holdings, 22, Vaijavoor Village, Malai Vaiyavoor P.O., Mahuranthakam Taluk, Kancheepuram Dist – 603 308.
7.	M/s. Maharashtra Seamless Ltd., Pipenagar, Village Subeli, N.H.17, B.K.G. Road, Taluk Rona, District Raigad, Maharashtra – 402 126.
8.	M/s. Mukut Tanks & Vessels, Surindra House, Safaid Pool, M.V.

	Road, Sakinaka, Mumbai-400 072.
9.	M/s. Taher Ali Industries & Projects (P) Ltd., Survey No.23/A, Agapally Village, Ibrahimpatnam, Sagar Road, R.R. District, Andhra Pradesh.
10.	M/s. Surindra Engineering Co.,Ltd., Surindra House, P.O.Box 8939, Mumbai.
11.	M/s. Pratibha Pipes & Structural Pvt., Ltd., Shrikant Chamber, Phase II, 5th Floor, Near R.K. Studio, Sion-Trombay Road, Chembur, Mumbai-71.
12.	M/s. Mukat Pipes Ltd., D-46, M.I.D.C., Baramathi, Pune-413 133.
13.	M/s. Subash Pipes Ltd., 279-280, Mysore Bannur Road, Ranganathpura Village, P.O. Rangasamudra District, Mysore.

(Any other reputed make as may be approved by BWSSB at a later date by producing the credentials). QAP to be submitted for the approval by the employer.

6. Sluice Valves

(a) All the Sluice valve shall be of resilient seated, glandless design generally confirm to BS 5163 -89/ IS 14846 -2000.Face to Face dimension shall be as per IS 14846-2000 only.

(b) Flanges shall be machined on faces and edges and drilled to IS 9523/IS 1538/BS EN 1092-1 based on the pipe drilling standard shall be adopted. Sluice valves shall be of non-rising spindle type.

(c) Sluice valve provided in all location of usage shall be only resilient seated.

(d) Valve of 400 mm and above shall be provided with thrust bearing arrangement for ease of operation.

(e) Valve of diameter 450 mm and above shall be provided with enclosed, grease packed spur gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.

(f) All valves, spindles and Hand Wheel shall be positioned to give good access for operational personnel. Valve buried or installed in underground chamber, where access to a hand wheel would be impractical, shall be operated by means of extension spindle and/or keys.

Valve shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position.

(g) All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

(h) Manufacturer is required to give details of proposed gear box i.e. nos. of spur pairs, ratio, efficiency etc. The Employer shall have these tested.

(i) The Valves shall be painted with Electro static epoxy powder coating both inside and outside with pocket less body passage for a minimum DFT of 250 Microns.

(j) Manufacturer is required to give justification with calculation that proposed valve is operable with the effort parameters specified and no. of turns to ensure the time required to operate the valve from full open to full close is within reasonable limits.

7. DUCTILE IRON PIPELINE

Scope

This specification covers the requirements for manufacturing, supplying, laying, jointing, testing and commissioning of Ductile Iron pipeline and fittings including associated civil works required for the same.

Standards

The following specifications, standards, and codes are part of this specification. All standards, specifications and codes of practice referred herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern,

IS:8329 Centrifugally Cast (Spun) ductile Iron Pressure pipes for water, gas and sewage.

IS:638 Sheet rubber jointing and rubber insertion jointing.

IS:1387 General requirements for supply of metallurgical materials**.**

IS:1500 Methods for Brinell Hardness test for metallic materials.

IS:9523 Ductile Iron fittings for pressure pipes for water, gas and sewage.

IS:12820 Dimensional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas and sewage.

ISO:4179 Ductile iron pipes for pressure and non-pressure – Centrifugal cement mortar lining – General requirements.

ISO:2531 Ductile iron pipes, fittings and accessories for pressure pipe lines.

IS:5382 Specification for Rubber Sealing rings for Gas mains, water mains and sewers.

AWWA C600 Installation of ductile iron water mains and their appuratenances.

IS:11906 Recommendations for cement-mortor lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water.

IS:3764 Excavation work – code of safety.

IS:12288 Code of practice for use & laying of Ductile iron pipes.

IS:460 Test sieves – Part I

IS:8112 Specification for 43 Grade Ordinary Portland Cement.

BS 3416 Bitumen based coatings for cold application, suitable for use in contact with potable water.

BS EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines – requirements and test methods.

ISO 81790 For zinc coating.

Manufacture of pipe

DI pipes and fittings (Class K7 & K9) shall be in accordance with IS: 8329 and IS: 9523. Pipes and fittings shall be procured from reputed manufacturers with Engineer's approval. Engineer shall at all reasonable times have free access to the place where the Pipes and fittings are manufactured for the purpose of examining and testing the pipes and fittings and for witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards specified above shall be performed by the Manufacturer / Contractor at his own cost and in presence of Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Engineer.

If the test is found unsatisfactory, Engineer may reject any or all pipes and fittings of that lot. The decision of Engineer in this matter shall be final and binding on the Contractor and not subject to any arbitration or appeal.

The pipes and fittings shall be stripped, with all precautions necessary to avoid warping or shrinking defects. The pipes and fittings shall be free from defects. Any defect in pipes and fittings in the opinion of Engineer shall be rejected and shall be replaced by new one.

In the case of spigot and socket pipes and fittings, the socket shall be without the centre ring.

In the case of flanged pipes, the flanges shall be at the right angles to the axis of the pipe and machined on face. The bolt holes shall be drilled and located symmetrically off the centre line. The bolt hole circle shall be concentric with the bore and bolt holes equally spaced. The flanges shall be

integrally cast with the pipes and fittings and the two flanges of the pipe shall be correctly aligned.

a). Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS: 8329 - 2000 and IS: 9523 - 2000.

b). Dimensions and Tolerances

The internal diameter, thickness and length of barrel, dimensions of pipes and fittings shall be as per relevant tables of IS: 8329/IS: 9523 for different class of pipes and fittings. Pipe of standard length of 6m is recommended and other properties for pipes and fittings shall be as per IS: 8329/IS: 9523. Each pipe shall be of uniform thickness throughout its length.

The tolerances for pipes and fittings regarding dimensions, mass, ovality and deviations from straight line in case of pipes shall be as per IS: 8329/IS: 9523.

Testing

(a) **Mechanical tests**

Mechanical tests shall be carried out during manufacture of pipes and fittings as specified in IS: 8329/IS: 9523. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 8329. The tests results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS: 8329/IS: 9523.

(b) Brinell Hardness Test

For checking the Brinell hardness, the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS 1500. The test shall comply with the requirements specified in IS 1500/IS 8329.

(c) **Retests**

If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the tests results satisfy the specified requirements, the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

(d) Hydrostatic Test

For hydrostatic test at works, the pipes and fittings shall be kept under test pressure as specified in IS 8329/IS9523 for a period of minimum 15 seconds, during which the pipes shall be struck moderately with a 700 g hammer for conformation of satisfactory sound. They shall with stand the pressure test without showing any leakage, sweating or other defect of any

kind. The hydrostatic test shall be conducted before surface coating and lining.

During manufacture, tests on pipes shall be carried out in accordance with **clause 1.2.8of this Technical specification** by the Third party inspecting agency.

Jointing of pipes

(a) General

Jointing of DI pipes and fittings shall be done as per IS: 12288 and manufacturer's recommendations. After jointing, extraneous material, if any, shall be removed from the inside of the pipe. Rubber sealing rings/gaskets used for jointing shall conform to IS: 638, IS: 12820 and IS: 5382.

(b) Spigot and Socket joints

These shall have sockets, which are integral with the pipe and incorporate an electrometric rubber ring gasket conforming to IS: 12820.

The gaskets/sealant used for joints shall be suitable for water conveyance. In jointing DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that the rubber ring as per IS: 12820 and IS: 5382 is correctly positioned in line, before the joint is made. The rubber rings and any recommended lubricant shall be obtained only through the approved supplier and as directed by the Engineer.

(c) Gaskets for Flanges

All gaskets used between flanges of pipes shall be of natural rubber conforming to IS: 638 of thickness 3 mm suitable for waste water conveyance and as specified by manufacturer.

(d) Flanged joints

These shall be of PN 1.0 rating and shall comply with dimensions and drilling details as specified in IS: 8329. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All material shall be supplied by a reputed manufacturer and shall be approved by the Engineer.

Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The recommended bolting torque to be followed for assembling flanges shall be as specified in manufacturer's instructions. The practice of fully tightening the bolts one after another is highly undesirable. The bolts shall be of mild steel unless otherwise specified. They shall be coated with coal tar epoxy coating after tightening.

Specials

Standard DI fitting shall be in accordance with IS:9523. Wherever standard DI specials are not available, they shall be manufactured and tested as per requirements with the approval of Engineer.

5.7 Coatings

i). General

Unless otherwise specified, DI pipes and fittings shall be coated with Bitumen in accordance with relevant IS specifications. All buried DI pipes and fittings shall also have factory or site applied polythene sleeving. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected at site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

ii). Bitumen coating

Bitumen coating shall be of normal thickness of 75 microns unless otherwise specified. It shall be cold applied compound complying with the requirements of relevant Indian standards, suitable for tropical climates, factory applied in accordance with the manufacturer's instructions.
Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

iii). Cement mortar lining

All pipes and fittings shall be internally lined with cement mortar in accordance with relevant IS. The cement used shall be Sulphate Resisting Cement confirming to IS: 12330. No admixtures in the mortar shall be used without the approval of the Engineer. The curing shall commence immediately after completion of the mortar lining, shall not be later than 8 hours after mixing of mortar. The lining shall be kept continuously in moist condition for a period of minimum 14 days.

Pipe linings shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 11906.

Marking

Marking shall be done as per IS: 8329 and IS: 9523 or any other relevant IS codes approved by the Engineer. The following information shall be clearly marked on each pipe,

a). Internal diameter of pipe.
b). Class of pipe.
c). Date of manufacture and
d). Name of manufacture or his registered trade-mark or both.

Carting & Handling.

Carting and handling of D.I. pipes and fittings shall be in accordance with the clause 3.4. of GSW pipes specifications.

Trenching.

Trenching includes all excavation which shall be carried out either by hand or by machine and shall be carried out in accordance with all requirements of part-2 Earth work excavations clause 2.0 to 2.17.wherever a socket or collar of pipe or fitting / special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all-round the socket in order to make the joint, and the grip shall be maintained clear, until the joint has been approved by Engineer.
Wherever D.I. pipes are laid over pillar supports for nala crossings etc. the pipes shall be placed as per the construction drawings and as directed by the Engineer In-charge.

The width of the trench shall be kept to a minimum consistent with the working space required and having regard to the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating and so as to provide the minimum horizontal clearance as stated in the table below. The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline.
The portion of the trench which extends from the formation level to not less than 300 mm above the crown of the pipe when laid in its correct position, shall, unless otherwise specified or ordered by the Engineer, be formed with vertical sides. The clearance between the sides and bottom of the trench and the barrel of the pipe shall not exceed the following, inclusive of any allowances required for temporary trench supports:

Pipe Nominal Bore (mm)	Bottom Clearance (mm)	Side Clearance (mm)
350 to 600	200	300
> 600 to 800	200	350

The clearance at joints may be increased to allow the joints to be made and inspected, any proposed increase shall be approved by the Engineer.
All trenches deeper than 1.2 m shall have the trench walls battered or supported to ensure the safety of all persons working in the trench if required. The Contractor is to provide details of these arrangements for approval by the Engineer prior to any work being undertaken in such a trench.
No excavations with battered sides shall be made in roads, footpaths, private gardens, or within 10m of any buildings or other structures.
The Contractor shall erect temporary fencing around all open excavations and post warning signs in English and the local language. All fencing shall be at least 1 m tall, rigid in nature and strong enough to prevent people falling into the trench. The Contractor shall also take all other necessary measures to ensure the safety of the public and others.

The maximum length of excavation which may be left open in any length is 500 m or as directed by Engineer. The opening of two lengths within 500 m of each other shall require the approval of the Engineer.
The excavation shall be kept free of water to allow: placing of bedding, laying of pipes. inspection and testing of joints, coating of joints, placing of backfill and other activities within the pipe trench, to be carried out in a satisfactory manner.
The excavation shall be done such that it does not get far ahead of laying operations. Before excavating trench the alignment of pipeline shall be approved by Engineer. Cuttings length and other appurtenances shall be provided to suit detailed pipe configurations required.
To protect persons from injury and to avoid damage to property, adequate barricades, construction signs. red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian standards and the rules and regulations of local authorities in regards to safety provisions shall be observed.
The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Contractor and approved by Engineer.
During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants. sluice valves, manholes cover etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organisations or otherwise as Engineer may direct.
Contractor shall take into account additional excavation if any as Engineer may require in order to locate the position of water pipes, drains, sewers etc. or any other works which may be met with, in or about the excavation of trenches while quoting the rates for excavation of trenches while quoting e rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Engineer ma direct, and shall be protected by the Contractor from damage during the progress of the work. Any damage to the service lines shall be borne by Contractor. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipe line of water, gas, sewage etc.

Laying of pipes and fittings.

Pipes and fittings shall be laid in accordance with IS 12288 and manufacturer’s instructions.

The pipeline shall be constructed in lengths with a separate full-time gang working on each length. The work on lengths may proceed

concurrently. The programme for pipe laying shall be submitted to and be approved by the Engineer at the start of the Contract. Any subsequent changes to the programme shall be submitted to and approved by the Engineer before work to a different programme is started. Excavation for the pipeline in anyone length shall not at any time proceed more than 2 km beyond the end of a hydraulically tested, completed and backfilled length of pipe, unless otherwise approved by the Engineer. The exposed joints between tested sections shall be disregarded in the above definition.

No metal tools or heavy objects shall be permitted to come into contact with the pipes or fittings. External coated pipe shall be handled at all times with wide non-abrasive canvas, rubber or leather straps or other equipment to prevent damage to the coating. The use of chains, wire slings, or any other handling equipment found to be injurious to the coating shall not be permitted. The timber or skids used to support the coated pipe prior to lowering into the trench shall be properly padded with sufficient bags stuffed with sand or straw for the purpose of protecting the coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to the protective coating from any cause must be repaired before the pipes or fittings placed in the trench. During laying operations, no debris, tools cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and they shall be carefully cleaned before jointing.

Pipes shall be laid accurately to the lines and levels shown on the Drawings, within a tolerance of ± 10mm.

Pipe alignments shall be straight between bends or curves. Length laid to curves shall only be allowed where shown on Drawings or in accordance with detailed proposals approved by the Engineer.

Properly painted sight rails shall be supplied and erected, with boning rods of predetermined measurement for the boning of individual pipes to the correct gradient. The sight rails shall be situated vertically above the line of the pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in position on each length of pipeline under construction to anyone gradient.

The Contractor may submit to the Engineer for his approval an alternative method of the control of pipe laying to the correct levels and alignment.

The joining of pipes shall be made in accordance with the requirements of this Specification. The Contractor shall obtain from manufacturers all special information regarding the handling of the pipes, joints and other fittings and he will be deemed to have made himself thoroughly conversant with all phases of pipe laying before commencing' the' works.

A "badger" or "bung" about 10mm smaller than the internal diameter of the pipe shall be kept in the pipe at all times, pulled forward as the work progresses. When pipe laying is not in progress, including overnight, the open ends of the pipeline shall be blanked off with a temporary watertight fitting approved by the Engineer. The pipe shall be suitably held down so

that the pipe does not become buoyant in the event of the trench becoming flooded.

To restrict the flow of rain runoff along the trench the Contractor shall plug the trench with backfill material at distances not exceeding 250 m until the pipeline can be filled in. The plugs shall be removed when trench filling is taking place. In granular bedding areas the plugs shall be of clay and shall be left in.

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas , sewage etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fittings shall be made by Contractor. In no case pipes and fittings shall be dropped. Slings of canvas or equally non-abrasive material of suitable width or special attachment to fit the ends of pipes and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and be rung with a light hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene/dye on the inside of the pipe at the suspected spot. No sign of kerosene/dye should appear on the outside surface. Pipes and fittings damaged during lowering or aligning shall be rejected by Engineer and shall be replaced by new one.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that the plug is on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted the deflection allowed at joints shall not exceed 2° for 600 mm and 800 mm, 3° for 300 mm, 350 and 450 mm diameter pipes.

The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner by using tools and taking precautions as per manufacturers' recommendations without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe: cutting machine shall be used.
The valve chamber frame and cover (Cast Iron and Fibre reinforced concrete) shall be as specified in Part 24. clause 24.3.11.

Nuts, Bolts, Washers and Gaskets

Unless otherwise specified, nuts, bolts and washers shall be galvanised and/or zinc electroplated to conform to the requirements of IS 1364. Bolts shall be of sufficient length so that at least one thread but not more than three threads shall protrude through the nut when in the fully tightened condition.

All gaskets shall be manufactured from SBR rubber in accordance with IS 5382. The dimensions of flange gaskets shall comply with BS 4865.

Anchor Blocks

Anchor blocks shall be provided at horizontal bends, vertical bends/ and at intervals on pipelines with gradients in excess of 1 in 6 as noted on the drawings, and at other locations ordered by the Engineer. The anchorages shall be made from concrete and constructed to the dimensions shown on the drawings. Where faces of anchor blocks are shown to bear against undisturbed ground, the contractor shall take all necessary measures to ensure that such bearing is given over the full dimensions shown.

Curves formed by welded bends and pipe lengths will not require anchoring unless specifically shown in the drawings.

Welded pipelines shown on the drawings as having tied couplings an flanges shall require anchor blocks only at the positions specifically noted on the drawings.

Vertical Thrust Blocks

Vertical thrust blocks shall be located wherever there is a transition between above ground and buried pipelines. All vertical thrust blocks shall have flexible joints at either end to allow for small amounts of settlement to occur. The contractor shall undertake the construction of the thrust blocks as early in of settlement to occur. The contractor shall undertake the construction of the thrust blocks as early in the program of work as is practical and at least six months prior to the installation of the above ground pipeline, in order to reduce the risk settlement of imposing additional loads on the pipeline supports.

Where possible the base of the thrust block shall be cast against solid rock in order to prevent any settlement. Any material overlaying the rock shall be excavated and replaced with class M15 mass concrete. In the event of no rock being encountered the base of the thrust block shall be cast against undisturbed ground. Any ground which in the

Engineer’s opinion is unsuitable shall be excavated and replaced with class M15 mass concrete.

Stubs

Stubs for air valves, scour valves and pressure relief valves of required dimensions as specified in the drawings shall be fabricated by the contractor and shall be fixed to the pipeline as per site requirement and instructions of the Engineer-In-Charge

Geogrid specification- Laying of Geogrid as per drawing and specification in accordance with MORTH specification clause 703.2.2 in two layers with proper confinement using GSB material of grade-II as per MORTH specification properly compacted in layers as per specification complete including verification of SBC.

Approved EMF Meters: Make- ABB, Scheinder, SIEMENS, Crone Marshal.

SECTION 8:

DRAWINGS

SECTION 9:

BILL OF QUANTITIES

Note:

(1) Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 11.2 and CC Clause 37.2).

(2) Unit rates and prices shall be quoted by the Tenderer in Indian Rupees.

(3) Where there is a discrepancy between the rate in figures and words, the lower of the two will govern. [ITT Clause 24.1(a)]

(4) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITT Clause 24.1 (b)]

SECTION 10:
FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT

To: _____ [name of Employer]
_____ [address of Employer]
WHEREAS _____ [name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and brief description of Works] (hereinafter called "the Contract");
AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;
AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;
NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Rs._____ [amount of guarantee] [63]_Rupees_____ _____[in words], and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [amount of guarantee][64] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.
We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.
We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.
This guarantee shall be valid until 30 days from the date of expiry of the Defects Liability Period.
Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date _____

[63] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract

[64] An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract